SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

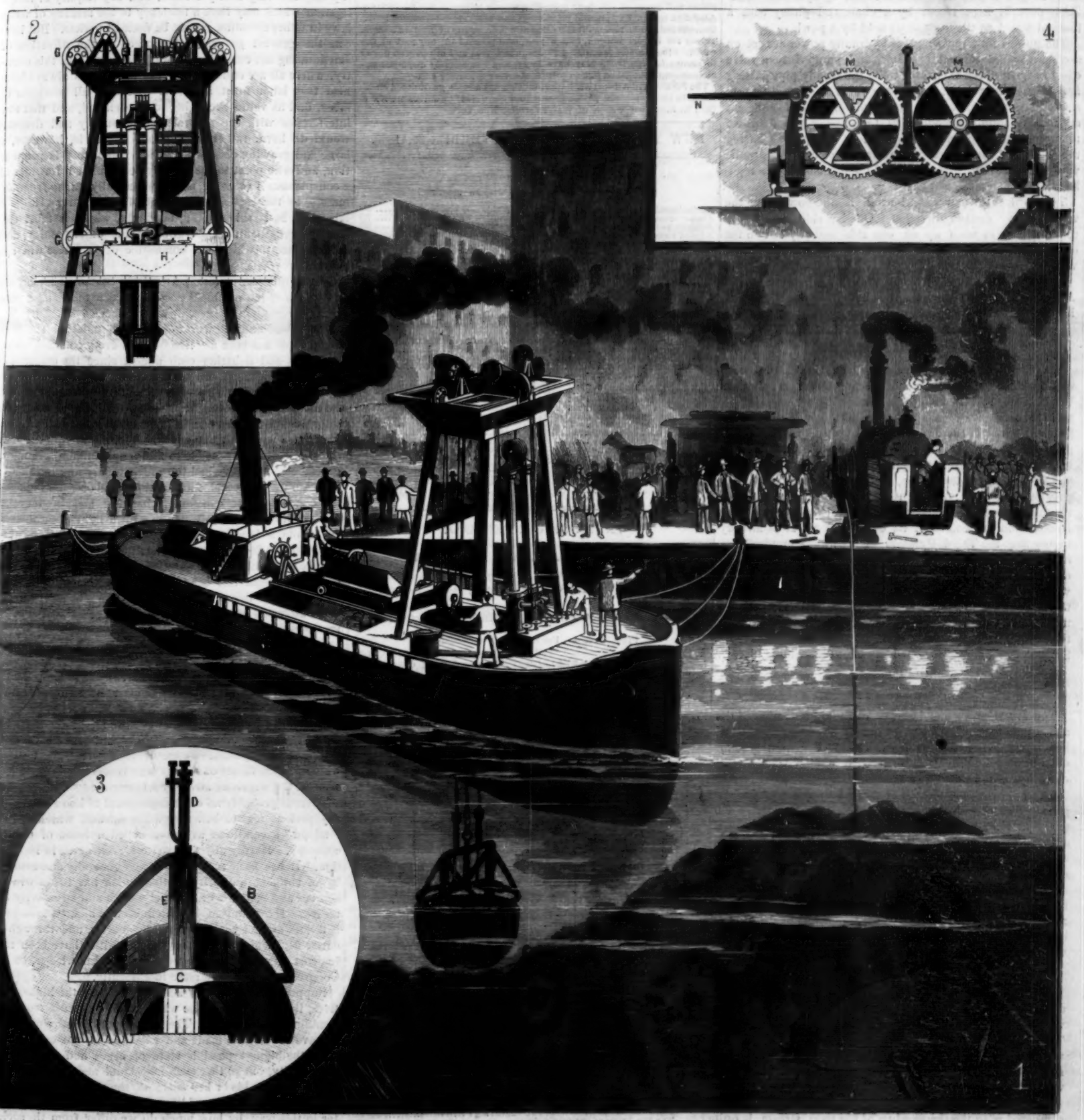
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLIX.—No. 13. [NEW SERIES.] NEW YORK, SEPTEMBER 29, 1883. [$3.20 per Annum. [POSTAGE PREPAID.]

EXCAVATING AND DREDGING APPARATUS.

In the apparatus herewith illustrated two winding engines, located one on each bank of the place to be dredged, draw a dredging plow over the bottom of the water way, scraping up the earth and carrying it to the sides of the channel, whence it can be raised during favorable weather. The excavating apparatus for removing the accumulated material is worked by hydraulic power on board of a steam hopper barge. The apparatus consists of a grab bucket, which is lowered open, and when it has reached the bottom hydraulic power is so applied that the operation of closing forces the bucket into the earth. As the bucket is raised a distributing wagon, running fore and aft on a railway, comes under it and receives the load, which it transfers to and dumps into the hopper located in the center of the boat. Still further aft are the high pressure pumps for supplying the hydraulic power, and which are driven by the steam engines used for propelling the vessel when it is not dredging.

The hull of the barge is constructed with a hopper well about in the center, and an excavator well in the bow. The latter is cylindrical and open at the bottom, and over it is a gantry frame, Fig. 2, fitted with brackets for carrying the gearing of the excavator bucket. The bucket, A, is hung by a chain over a number of sheaves on a hydraulic multiplying tackle and on the frame, and is raised and lowered by the chain and tackle. The bucket is almost hemispherical, and is made in two segments whose contact edges may be either toothed or solid. The bucket shown in the accompanying engravings is made of pointed tines or curvilinear bars of steel, bolted at their upper ends to semicircular frames, the points of the two segments intersecting when closed. The frames have bosses to receive the pins on which the two parts of the bucket swivel. To prevent the bucket from catching against the bottom of the vessel there are curved guards, B, braced by a crossbar, C. On the suspension frame is a pair of hydraulic cylinders (one is shown at D), whose piston rods work up and down in the vertical guides, E, in which moves the crossbar. This bar is connected to the two segments of the bucket by two pairs of jointed links, so that when the bar is forced down by the action of the pistons the segments are closed. The hydraulic power for closing and opening the bucket is conveyed to the opposite ends of the cylinders by flexible hose pipes capable of withstanding a pressure of 2,000 pounds to the square inch. These pipes, F, Fig. 2, are rove over two sets of sheaves, G G, the lower blocks of which rise to pay out the hose as the bucket descends, and fall as the bucket as-



SMITH'S EXCAVATING AND DREDGING APPARATUS.

cends. The two sets of hose are arranged at opposite sides of the frame, and are actuated from a double acting supply and exhaust valve in the valve chest shown at H.

A wagon runs on rails laid over the two wells, and motion is communicated to it by the rising and falling of the excavator. A crossed wire rope runs upon a pair of V-grooved pulleys, each of which has three grooves of different diameters, so that the ratio of the travel of the wagon to the depth of stroke of the excavator may be adjusted. These pulleys, or speed cones, are placed on top of the frame. On the shaft of one of these pulleys is a cone having a spiral path around it, and on the side of the frame near the bottom is a similar cone. Around these two cones passes a pitch chain. The lower cone drives an endless chain traveling in a direction parallel with that of the railway, and to which the wagon is fastened by an arm shown at L, Fig. 4. The speed of the wagon is so varied by the cones, that it moves fastest when under the bucket. The wagon as it comes up for its load strikes against spring buffers which are held back by spring checks, and the same motion which opens the valve to lower the excavator releases these springs, which then exert their force against the wagon.

The wagon is constructed in two segments, hung on centers on which is a pair of intergearing toothed wheels, M. On one center is a disk having a recess for the tooth of the tripping lever, N. When this lever is depressed, the disk is liberated and the weight of the load opens the two segments, which close of their own weight after the load has fallen and are held shut by the tooth dropping into the recess.

The hopper well is closed at the bottom by a number of doors hinged to the keelson and raised by hydraulic rams. Each door is kept closed by a chain and pulley with a toothed wheel on the same shaft held by a pawl.

The pumps for supplying the hydraulic power are set on a cistern containing oil or water, and pump into a valve chest in front of the excavator well; the supply pipe passing first to an accumulator, then to the valve chest, and then to a second accumulator. The accumulators are of sufficient capacity to supply the cylinders for closing the doors of the hopper and to equalize the work of the pumps during the moving of the bucket. There are five ordinary hydraulic valves in the chest, from which all the movements are regulated.

Two hydraulic capstans, located in the bow, move the vessel in any desired direction. One has side chains rove round it so as to wind up on one side and pay out on the other. The forward capstan controls the forward and backward motion of the vessel.

A patent was recently issued to Mr. William Smith, of Aberdeen, North Britain, for the above described excavating and dredging machine.

The Greatest Obelisk.

The Washington correspondent of the Cleveland *Leader* writes: The Washington monument is the wonder of Washington, and its beauty the admiration of both Americans and foreigners. Already over 350 feet high, it rises from the banks of the Potomac a great white marble shaft, piercing the clouds, and backed against the blue of the sky. It is already the grandest obelisk the world has ever seen, and in the eons of the future, should the nations of the day pass away, leaving no more records of their progress than the mighty ones of the Egyptian past, it will surpass the Pyramids in the wonder of its construction. It is already higher than the Third Pyramid, and within a hundred feet of the size of the second. It is taller than St. Peter's Cathedral, and when finished it will be the highest structure in the world. To-day the Cathedral of Cologne, 512 feet high, is the tallest work in the world. Next comes the Great Pyramid, 483 feet high; then the Strassburg Cathedral, 473 feet; then the Second Pyramid, 453; then St. Peter's, 430; St. Stephen's at Vienna, 443; and St. Paul's at London, 384.

Transfusion of Blood.

The *Presse*, of Vienna, lately described an operation of the above kind successfully carried out by Professor Nothnagel in conjunction with Herr Ritter von Hacker. On account of the unsatisfactory results recently obtained in several cases by using human and lamb's blood, it was resolved to try a better method, already suggested by several physiologists. This consisted of a solution of common salt of 0·6 per cent rendered alkaline by two drops of concentrated solution of soda. The patient treated on this occasion was a young man who was in imminent danger from weakness of the heart, consequent upon loss of blood by reason of an abscess in the stomach. An incision was made in a vein in the upper part of the arm, and by means of a funnel-shaped receptacle about two pints and three-quarters of the fluid in question were introduced into the system of the patient, who is now expected to recover.

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Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 261 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, SEPTEMBER 29, 1883.

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 404,

For the Week ending September 29, 1883.

Price 10 cents. For sale by all newsdealers.

"LABOR AND EDUCATION."

A committee of Congress has been "investigating" these subjects for some weeks past in New York city. The testimony elicited has covered a wide range of topics, and furnished much interesting reading matter for the daily press. Jay Gould has narrated, with lamb like innocence, in a story that reads like a novel, how he accumulated his colossal fortune; Dr. Norvin Green has described the telegraph systems of this and other countries in a way which makes it appear that the Western Union corporation is a great public benefactor; John Roach has told us about ship building, and how necessary are subsidies, if we would once more see a due proportion of the world's commerce done under the starry flag; Railway Commissioner Fink has explained how railway charges are regulated—how railway "pooling" prevents railway "wars"—and all for the public benefit; while many other witnesses, representing various isms, trade organizations, and the different industries, have given some important facts and a good deal of theory as to what Congress should or should not do to promote the cause of education, and for the benefit of the "laboring classes"—so self-styled by the great majority of workers who labor for a low rate of daily or weekly compensation.

This congressional committee was appointed principally in consequence of the numerous "strikes" in various parts of the country—caused generally by trade-union organizations; it has, also, been repeatedly urged that the general government should do something to promote popular education, particularly with regard to the former slave population, and so this subject was joined with the other. Primarily they are very nearly related, and any inquiry or investigation which may have a tendency to the making of wiser laws in either direction cannot be deemed useless. But how can the general government proceed in the direction of ameliorating the condition of wage earners? In this country, where all are equal before the law, it has always been held that labor must, as is the case with all products of labor, find its value according to the demand, and that any interference with the natural law of supply and demand would do harm rather than good. There is, however, a large and growing class who do not assent to this proposition, and who point to the rapidly accumulated fortunes of a conspicuous few as so much wrongfully taken from the masses, to the especial detriment of the poorer classes of laborers. It is this feeling, no doubt, which is most efficiently strengthening the various trade unions to-day, and in deference to which the committee of Congress was appointed.

Of the questions more particularly examined into as affecting labor, the principal ones have been the tariff, a proposed government ownership of railroads and telegraphs, convict labor, and the workings of trade unions. The first named topic has been a "live" one in every counting room, workshop, and debating club almost since the commencement of our history. From the tariff the government derives its principal revenue—but how economical it has been as a method of collecting taxes—how far it has been a prime factor in building up our industries—to what extent it has given extra wages to our workmen—these are questions on which it seems impossible to find any common ground of agreement. We have had too much theory and too small a modicum of the actual facts as they bear on each industry. The conditions are constantly changing, and the inquiries of the committee have thrown but little light upon the subject, while it is safe to say that their results will be absolutely *nil* as affecting tariff legislation, only as they help to educate the public. The question of government ownership of the telegraph has been agitated ever since England set the example in this direction, and was brought more directly to the attention of the committee by the recent strike of the operators.

Of this, however, as of the suggested government ownership of railroads, it may be said to require only the dullest perception to perceive that any apparent gain to labor thereby would be vastly more than balanced by added taxation. And the reasons why the government should go into such business may be very readily applied in advocacy of its taking up still other branches, until it would be difficult to fix a limit to the possible scope of its interference until the whole present fabric of society was reorganized, as, indeed, some of the witnesses advocated.

There is probably no other department of knowledge, with any pretensions to being styled a science, which is in so "mixed" a condition as the so-called science of political economy. Hardly any two writers even agree in its definition. It has been most broadly and generally characterized by an eminent authority as that which has to do with the sources and methods of material wealth and prosperity in a nation. Here, indeed, is a definition which "surrounds," if it does not get very close to the matter, and through the entire field which it suggests the committee have been making sort of guerilla raids in search of knowledge, so that Congress may legislate more intelligently.

Supposing its members actuated only by the highest motives, it is difficult to see what good can result from such rambling questionings. Theoretically, at least, we all want to have the laws so made and executed as not only to conserve the highest possible state of peace and order in the community, but so that each individual may have an equal chance to earn his or her share of the necessaries, the comforts, and the luxuries of life. But when we state the matter in this way, by how much do we differ from the society which Plato would have had in his model republic?—where

each would have had for his task that for which he was best fitted, where there would be no over-reaching by the strong and crafty, no oppression of the weak and feeble, and all would be able to realize the highest happiness possible for mortals. It may be that our investigators, as seems possible with some of their witnesses, have this in their mind; but this is a practical age, and the public would have had greater confidence in their accomplishing something for good, if ever so little, if they had confined themselves to a much narrower range of investigation.

AUTOMATIC SAFETY APPLIANCES.

It is a trite saying, that in the knowledge of danger there is safety; but this, like many other old saws, is only partially true. The many discoveries and improvements which, during the last half century, have been made in science and the mechanical arts, while they have conduced to the comfort and conveniences of the world, have for the most part been fraught with dangerous and apparently unavoidable concomitants. Many accidents, it is true, might be avoided by unremitting watchfulness, but we have to take human nature and physical endurance as we find them, and it is only in automatic safeguards that in many cases reliance can be placed.

Automatic signals, switches, and self-acting gates at crossings are not in as frequent use on our railroads as they should be. These and many other safety devices fail to be adopted, either from some false notion of economy, or from a wrong system of reasoning that, where implicit confidence is placed in them, and they accidentally omit to perform the duty assigned them, the consequences are most serious or fatal. This may be true in a measure, because we have to do with perishable materials and imperfect workmanship, but it nevertheless is unsound argument. There is no necessity to rely exclusively upon self-acting devices against accident, but, wherever the same can, they ought to be adopted as additional means of securing safety, and we think that the time is not far distant when they will be thus employed more generally than they now are. Notwithstanding the much that has already been proposed and done in this connection, inventors should not be discouraged because the harvest is not yet ripe. The field is a wide one, and by no means fully explored as yet.

Railroad accidents occur, at times, owing to the failure of the air brakes to act when called into requisition upon some particular occasion, but this does not condemn these devices; they are useful and great means of safety notwithstanding. So it is with automatic safety appliances generally. Additional devices for securing safety and sufficient manual or other force to work them should also be provided. No single safety expedient is reliable. Such devices should always be duplicated or alternatives be at command, and we think that, so far as automatic means are concerned, provision should invariably be made for making them part of the ordinary working plant, so that, although not acting with their full force excepting when needed, they will not rust or bind, but be kept in good working order; or, if this cannot be done, then they should be operated occasionally, at stated periods, to insure their efficiency.

Much attention is now being directed to automatic safety contrivances in connection with that modern substitute for long flights of steps in our lofty buildings, the passenger elevator; and although considerable has been already done in this line, and many inventors may find their proposed expedients anticipated, there is still great room for improvement and a fortune to the discoverer of the best device for the purpose. In the same category should not only be included freight elevators, but the many kinds of hoisting machinery in use for different purposes. Take, for instance, the chain hook tackle or grapple employed in our stores and warehouses for receiving and delivering goods in casks and other like packages. How many men are crippled and lives lost by the slipping of the load from the hooks while being raised and lowered through hatchways from one story to another? This need not and ought not to be, as safety devices to catch and hold the load till the hooks could be readjusted might be easily devised. We know of one large warehouse in a neighboring city where accidents from this neglect are of almost daily occurrence.

There are many instances, however, besides these, in which self-acting safety means might be advantageously adopted. We will only mention a few as they occur to us. Automatic fire alarms might be introduced into our dwellings and tenement houses, which either flame or an undue rise of temperature would operate, and so wake the sleeping inmates; this might either be done mechanically or by the breaking or closing of an electric circuit. Self-closing gas taps, too, in the sleeping apartments of our hotels, that is, taps which would close when the light is blown out or otherwise extinguished, and that would require a special manipulation to open them again, might save many a verdant country cousin, careless person, or inebriate from dying of asphyxia. Again, if pistols were made that, by the act of loading them, would expose, and keep exposed till firing them, a plain and unmistakable indicator of their loaded condition, we should read of fewer of those lamentable occurrences in which death results from the foolish practice of pointing at another, though only in jest, a weapon erroneously supposed not to be loaded; and the timid, too, would be less likely to carelessly handle a fire arm that pronounced itself ready to kill.

But why enumerate? The subject of automatic safety appliances is an extensive one, and well worth the attention of the ingeniously inclined, who would also have the comforting reflection that their efforts were being directed toward the saving of human life.

ASPECTS OF THE PLANETS FOR OCTOBER.

JUPITER

is morning star, and wins the place of honor in the monthly presentation for the surpassing beauty of his appearance as well as for the fact that his approach to the earth will soon bring him into a position favorable for telescopic research. No planet in the solar family exceeds in interest for terrestrial observers the one that holds a place second only to the sun in size and majesty. The desire to learn something new concerning our giant brother increases every year, while the constantly recurring red spots, white spots, and intensely colored belts are proofs of Jovian activity that whet the curiosity of diligent observers. Not many aspects of the huge planet's disk at the coming opposition will escape the attention of eager watchers who make a specialty of Jovian astronomy.

On the 27th, at noonday, Jupiter is in quadrature with the sun on his western side, being the third of the great planets to reach this epoch in the synodic course. The Prince of Planets then beams from the starry depths just 90° in longitude west of the sun, rising about six hours after sunset, being near the meridian at sunrise, and setting about six hours after sunrise. Thus, attended by a brilliant retinue of stars, he travels with stately step on the celestial road, and reigns the brightest of them all through the still watches of the silent night.

On the 19th, at one o'clock in the afternoon, Jupiter is in conjunction with Mars. The two planets are then 59′ apart. They will be near enough together to be worth observing when they rise, soon after eleven o'clock, on the evening of the 19th. The ruddy hue of Mars and the golden tint of Jupiter make an interesting contrast, and as clearly determine the individuality of the planet as the familiar features of well known friends distinguish them from each other.

The right ascension of Jupiter is 8 h. 12 m.; his declination is 20° 13′ north; and his diameter is 34″.

Jupiter rises on the 1st about a quarter after twelve o'clock in the morning; on the 31st he rises at half-past ten o'clock in the evening.

SATURN

is morning star, and ranks second to Jupiter in the exceeding beauty of his appearance, shining with a softer light and paler hue. He contributes little to the incidents of the month, but, holding his position near the Pleiades and Aldebaran, contents himself with playing the part of the celestial gem that shines serenely in the heavens, and attracts the admiration of every one whose eyes are turned toward the stars when his presence crowns the night.

The right ascension of Saturn is 4 h. 35 m.; his declination is 20° 1′ north; and his diameter is 18 2″.

Saturn rises on the 1st about half past eight o'clock in the evening; on the 31st he rises about half-past six o'clock.

MARS

is morning star, and comes in for the third place, as he has already attained noticeably increased dimensions and taken on a somewhat fiery hue. An event of unusual interest occurs this month in the progress of Mars. The constellation Cancer, or the Crab, contains a nebulous cluster of minute stars known as Praesepe. The cluster is luminous enough to be distinctly seen by the naked eye on moonless nights. On the 24th, at noonday, Mars is in this cluster, and when he rises in the evening about 11 o'clock, he will be an interesting object for observation, especially through a telescope. There is no need of describing his position, for he is then a short distance to the northeast of Jupiter, and can be readily recognized.

On the 31st, at midnight, Mars takes his turn in coming into quadrature with the sun, the fourth on the list, Neptune, Saturn, and Jupiter having taken the precedence. It will be noticed how nearly Mars and Jupiter travel in the same path, and how close they seem together, though hundreds of millions of miles and the whole family of the asteroids intervene between the outermost of the inner group of planets and the innermost of the outer group of planets. We have referred to the conjunction of Mars and Jupiter on the 21st.

The right ascension of Mars is 7 h. 43 m.; his declination is 22° 14′ north; and his diameter is 7″.

Mars rises on the 1st about half-past eleven o'clock in the evening; on the 31st he rises a few minutes before eleven o'clock.

URANUS

is morning star, and ranks as the fourth for the part he plays on the monthly record. On the 13th, at seven o'clock in the morning, he is in close conjunction with Beta Virginis, being only 5′ north of the star. It will require a powerful telescope to bring to view planet and star after their appearance above the horizon about four o'clock.

The right ascension of Uranus is 11 h. 41 m.; his declination is 2° 43′ north; and his diameter is 3·4″.

Uranus rises on the 1st not far from a quarter before five o'clock in the morning; on the 31st he rises at three o'clock.

NEPTUNE

is morning star and enjoys the distinction of being the first of the morning quintet to appear above the horizon. He is called a morning star, although he rises early in the evening. But the outer planets are all classed as morning stars from conjunction to opposition, regardless of the time of rising. Neptune is rapidly approaching his nearest point to the earth, and if he were not so far away would afford more material for research. To him belongs the honor of being the only planet whose presence was felt and position mapped out before he was actually discovered.

The right ascension of Neptune is 3 h. 15 m., his declination is 16° 12′ north, and his diameter is 2·6″.

Neptune rises on the 1st at half past seven o'clock in the evening; on the 31st, he rises at half past five o'clock.

MERCURY

is evening star until the 6th, and morning star for the rest of the month. On the 4th, at nine o'clock in the morning, he is in conjunction with Venus, the former moving westward toward the sun, and the latter moving eastward from the sun. Both planets are so near the sun that the meeting will be invisible to terrestrial observers.

On the 6th, at eight o'clock in the evening, Mercury is in inferior conjunction with the sun, passing between the earth and the great luminary, and becoming morning star as he reappears on his western side.

On the 20th, at two o'clock in the afternoon, he is in conjunction with Gamma Virginis, being 1° 7′ south of the star. Bright-eyed observers may possibly see the near approach of star and planet on the morning of the 20th, for the planet is then visible, and the star will be a guide to its position. But the atmospheric conditions must be nearly perfect, or the observation will be in vain.

On the 22d, at ten o'clock in the morning, Mercury reaches his greatest western elongation, being at that time 18° 22′ west of the sun. This is the last favorable opportunity during the year for seeing Mercury as morning star. He rises on the 22d an hour and a half before the sun, and must be looked for 9° north of the sunrise point. He will be visible at that time, and also for several days before and after elongation.

The right ascension of Mercury is 13 h. 5m., his declination is 10° 34′ south, and his diameter is 9·8″.

Mercury sets on the 1st about a quarter before six o'clock in the evening; on the 31st he rises a quarter after five o'clock in the morning.

VENUS

is evening star, and the only planet playing the part of evening star during the entire month. She might as well be blotted from the sky as far as observation is concerned, but she will make up all deficiencies by the splendor of her appearance in midwinter.

The right ascension of Venus is 12h. 42., her declination is 3° 12′ south, and her diameter is 10″.

Venus sets on the 1st a few minutes before six o'clock in the evening; on the 31st she sets about half-past five o'clock.

THE MOON.

The October moon fulls on the 16th, at 37 minutes after one o'clock in the morning, Washington mean time, or 49 minutes after one o'clock, New York time. The new moon of the 1st passes near Venus and Mercury on the morning of the change. The full moon of the 16th is in close conjunction with Neptune on the 17th. She is in conjunction with Saturn on the 19th, about four o'clock in the morning, being 1° 13′ south. In some localities between 47° and 70° south declination, the moon occults Saturn for the seventh time during the present year. On the 23d, the moon is at her nearest point to Jupiter and Mars at nearly the same time. On the 27th, she passes Uranus, and on the 29th she is near Mercury for the second time. On the 31st, the second new moon of the month is near Venus.

ECLIPSE OF THE MOON.

There will be a partial eclipse of the moon on the 16th, visible in the United States and on the Pacific Ocean.

The eclipse will commence at 1 h. 2 m. A.M., New York time. The middle of the eclipse will occur at 1 h. 58 m. A.M. The eclipse will end 2 h. 54 m. A.M. As but twenty-eight one-hundredths of the moon's diameter is obscured, the phenomenon is remarkable for being the only lunar eclipse visible in this latitude during the year.

ECLIPSE OF THE SUN.

An annular eclipse of the sun will occur on the 30th, visible on the Pacific Ocean, and partly visible on the Pacific coast of North America and Asia. As the ring of sunlight surrounding the moon's dark disk will be invisible in this region, the event will be of little importance. An annular eclipse, though a beautiful phenomenon, bears no comparison to a total one in scientific importance.

The inhabitants of the islands of the Pacific will not be likely to entertain the men of science during its occurrence, though the moon casts her shadow over the same waste of waters and not very far distant from the lone island made memorable as the point of view for observing the total eclipse of the 6th of May.

Product of the Hen.

The hen has in her ovaries, in round numbers, more than 600 egg germs, which develop gradually and are successfully laid. Of these 600 the hen will lay 20 in her first year; 135 in her second, and 114 in the third. In each one of the following four years the number of eggs will be diminished by 20, and in her ninth year she will lay at most 10 eggs. In order to obtain from them sufficient product to cover the expense of alimentation, they should not be allowed to live over four years.—*Annales de la Sociedad Odontologica, Havana.*

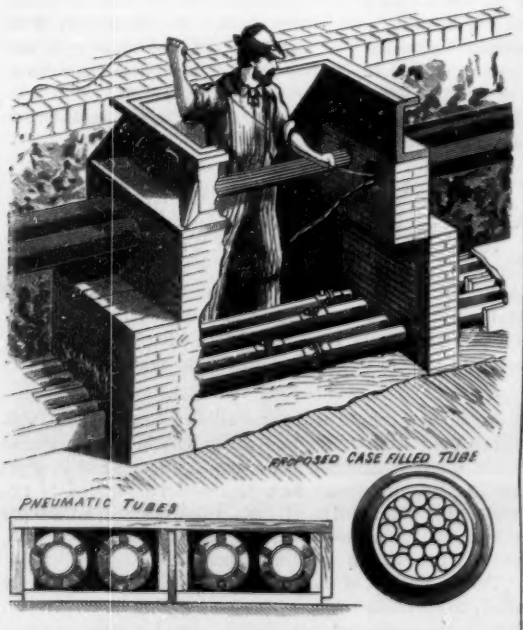
Texas.

General McClellan, who has recently visited many parts of the Texas Panhandle, predicts that by the year 1890 the State will have a population of 5,000,000, while he also affirms that it can support 20,000,000 without overcrowding. The capabilities of Texas are only just being discovered; it is larger than France, with a better soil and an equal climate, is well watered, and is being completely intersected by railroads. There was a large increase of population between 1870 and 1880, and there will be a still larger during the present decade. The State is already second only to Georgia in the production of cotton, and it produces more cattle than any other two States. It is anticipated, moreover, that the social and commercial relations between California and the Southwest will in a few years become very close.

The Northwest Texas Cattle Raisers' Association has recently been in session at Fort Worth. The organization has a membership of 223, who each own from 1,000 to 60,000 cattle, and represent a grand total of 1,400,000 cattle. There are several members who can boast of the ownership of from 40,000 to 60,000 head, and fourteen who lay claim to over 20,000. A striking instance of the profitable nature of the ranching business is furnished by the brothers Hartwell, who went from Bloomington, Ill., in the fall of 1875. The aggregate of their worldly possessions amounted to $48,000. This sum they invested in 4,500 cattle. Now they are the owners of 60,000 head, and are worth at least $1,500,000. The largest ranch in the State is that of Mr. Charles Goodnight, at the head of Red River. He began buying land only four years ago, and now he controls 700,000 acres. To inclose his landed possessions, 250 miles of fencing are required. He has the finest, though not the largest, herd of cattle in Texas. His recent sale of yearlings fetched $20 per head, the average price being $15. The Matador Cattle Company's ranch is another immense property, which was recently sold to a company of Scotch capitalists for $1,250,000.

A Useful Bath Bed.

A correspondent in the *Lancet*, writing from Liverpool, describes and recommends the following substitute for a water bed, which has been introduced into an infirmary in the latter city. It consists of a large wooden tank, about five feet long by two and a half feet broad, and a little more than a foot in depth. It is lined inside with zinc, and has a tap fixed to the bottom for draining purposes. It is supported on an iron bed cot, and is filled with water to within a few inches of the top. A large mackintosh sheet is spread over the surface of the water and allowed to fall over the sides of the tank for a foot or so on each side. This sheet may be fastened, if necessary, to the side of the tank. The patient is laid on the mackintosh sheet, a blanket or linen sheet intervening, and he practically floats in the water. The water can be kept at any temperature that is thought proper. At present the bath bed is being used for a case of typhoid fever with hyperpyrexia, and is filled with cold water at a temperature of 60° F., so that the patient has all the benefit of the cold water treatment by plunge bath or douche without the many inconveniences. In many cases of collapse, also where warmth is useful, the temperature of the water can be raised to 80° or 90° F., and kept at that temperature. The bath bed can be used besides for cases of prolonged illness with tendency to bedsores, for the prevention of which it is superior to the ordinary water pillow.



WESTERN UNION UNDERGROUND SYSTEMS.

W. H. HERRICK, whose engraving of automatic water still appeared on page 146, present volume SCIENTIFIC AMERICAN, desires parties to address him at Grinnell, Iowa.

IMPROVED PLOW.

Letters patent have recently been issued to Mr. Charles C. Coleman, of Honolulu, Hawaiian Islands, for an improved double mould board furrowing plow, the object of which is to make a furrow from 12 to 16 inches deep in previously plowed and prepared land for planting sugar cane. The essential feature of the plow consists in making the mould board so that all its horizontal lines from the apex to the rear end are straight instead of concave, as heretofore made. This form presents the same angle to the earth all the way from front to rear, thereby avoiding the greater angle along the rear part, which causes the earth to clog until the cavity is filled up to a straight line, making the plow draw very hard by reason of the increased friction and of the mass of earth that must be pushed ahead. The mould boards are extended higher and lower and also further back to prevent the earth from running back into the furrow when plowing deeply, and also to enable the angles of the board to be made sharper for a given width of furrow. The inventor states that he has found, in actual use, that the plow readily clears itself in soil which cakes on the ordinary plow.

COLEMAN'S IMPROVED PLOW.

THE WESTERN UNION UNDERGROUND SYSTEMS.

Two systems of underground tubes are now being laid in this city to connect the Western Union building, at the corner of Broadway and Dey Street, with a new structure now being erected by the company on the southwest corner of Fifth Avenue and Twenty-third Street, a distance of about two and a half miles. For convenience in constructing, both systems are being placed in one trench, the lower, or pneumatic one, being sunk below frost line, while the other, designed for electrical conductors, is about midway to the surface.

The pneumatic system is, practically, the extension of similar methods which the company has used for shorter distances during several years. By its use the present delay, caused by telegraphing messages from uptown stations to the central office and there recopying them, will be avoided, as the first copy taken will be sent direct through the tubes. As the work has but just been commenced, we can give only a general idea of the projected plan, omitting all details. There are four separate lines of brass tubes, whose ends are bolted together and which are inclosed in pairs in flat boxes. When in use the exhaust and pressure methods will be combined; that is, engines will furnish an exhaust in front of the piston carrying the message, and at the same time exert a pressure behind it.

The upper system may be considered as the beginning of the movement to place all telegraph wires in the city underground. The capacity of the pipes now being laid is not only amply sufficient to carry all the Western Union wires which, from their location, belong in them, but there will be room for future demands. Extensions will be made when practicable, and as fast as possible the overhead wires will be transferred to the tubes.

This system consists of two iron pipes five inches in internal diameter, the joints being made in the ordinary way with lead and jute. The engravings show the manhole from two points of view; one looking perpendicular to the line of direction of the trench, and the other at right angles

The manholes are walled with masonry as shown, and of a size sufficient to easily admit a man, and are about 400 feet apart. A single iron wire is pushed through, as the sections of pipe are laid, from one manhole to the one adjoining, and to this wire the cables will be attached and pulled through. The inductors will be No. 16 copper wire insulated with either kerite or gutta-percha, but in localities where the heat from the steam pipes will be felt, it may be necessary to substitute rubber. It is calculated that the tubes will carry 300 wires.

After a cable has been placed in position in the tube it becomes a difficult matter to remove it when, for repair or other purpose, this is desired. This will be especially difficult if the defective cable should happen to lie in the bottom of the tube; the weight of the other cables bearing upon it and the long distance it would have to be pulled would make a resistance sufficient to strip it of its coating. To obviate this a plan has been proposed of filling the interior of the iron tubes with small tubes made of paper, in each one of which a cable would be placed. The removal of any particular one would then be an easy operation requiring but little time and labor. In the lower corner of one of the engravings is shown a cross section of a tube filled in this manner.

Hemlock as a Beverage.

The *Northwestern Lumberman* claims that until lately beer has never been supposed to have any very intimate connection with the lumber business, except it adds as an internal fuel to fire the ardor of a lot of dock wallopers or to induce a lot of men to hustle up a drive. Now it is asserted that beer is made of which hemlock bark is a principal ingredient, though it never has had much of a reputation beyond the modesty of a plain tea. The cargo arrivals of hemlock bark are numerous, and it is stated by persons who claim to understand the ropes that the tanneries are not the only importunate consumers, but that the bark is extensively ground and sold to makers of beer at outside points. How much or how little is consumed in Chicago in that way seems to be a vague proposition. The following elucidation of the subject has been furnished by a man who investigated it:

It is used as an adulteration for beer. Large quantities of it are ground up and shipped to other points. Chicago brewers can afford to make pure beer, and the *Lumberman* says they do; but this bark is fixed up here and sent to other places. I suppose you know, adds the writer, that brewers do not report the ingredients of which their beer is made, as they once did. The courts have decided that they are not compelled to do so. I have made some casual inquiries, and I learn that tanbark and soda are the principal substances used. A little rice malt gives it body and makes it hold the foam. Hemlock bark is a new discovery in this respect, and is useful because it takes the place, to a certain extent, of both malt and hops. It is not poisonous, but it certainly cannot be said to contain any nourishment. It adds the pungent, bitter taste, and gives the dark reddish color to the liquid. It is very cheap, and the brewers who use it must grow rich very fast.

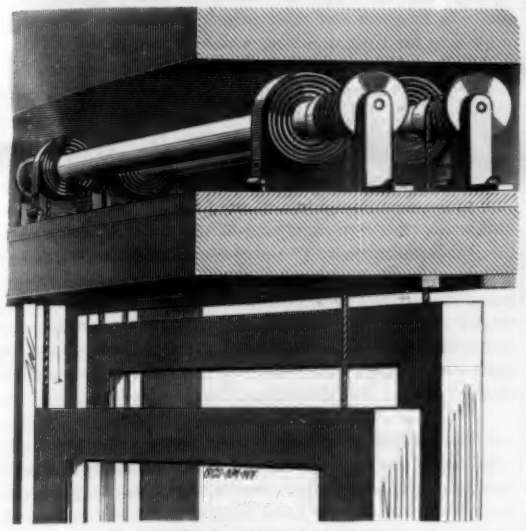
Passage of a Ramrod through the Brain.

Dr. G. Fisher reports an instance of recovery after severe injury to the brain, which recalls the well known case of Dr. Harlow, of Vermont, in which a tamping iron was forced through the head by a premature explosion. In this case an iron ramrod was discharged during the loading of a gun. It entered the back to the right of the fourth dorsal vertebra, passed upward along the ribs, and through the muscles of the neck, and forced a passage through the skull and the brain, projecting out nearly twelve inches from the left side of the head. An incision was made in the neck, and the ramrod was forced back by a hammer and extracted through the wound thus made. The patient recovered, but lost the sight in the right eye. A ramrod being propelled in the same direction through a dead body, it was found that in its course through the neck no important nerves or vessels were injured. The instrument passed through the right optic foramen, tore the optic nerve, and passed through the fissure between the frontal lobes. The destruction of brain substance in this region was only a little over an inch in extent, and was confined to the anterior portion of the left frontal convolution. According to our present knowledge, such an injury should cause no motor or sensory disturbances. The author apprehended the appearance in time of insanity as the result of the accident.—*Centralbl. für Klin. Med*, *August* 18, 1883.

WESTERN UNION UNDERGROUND SYSTEMS.

IMPROVED SASH BALANCE.

The novel sash balance shown in the engraving is the invention of Mr. George W. Arnold, of Knoxville, Ill. This device replaces weights and the ordinary springs, and provides a really mechanical device for balancing window sash. The invention consists of a miniature windlass provided with two coil springs, one near each end, the inner ends of the springs being fastened to the roller, and the outer ends secured to the top of the window frame. The bearings of the rollers are also secured to the top of the window frame, and cords extend from the ends of the rollers downward through holes in the window frame and are attached to the sash. The springs are put under sufficient tension to nearly



ARNOLD'S SASH BALANCE.

lift the sash. When the sash is raised the cords are wound upon the roller, and when the sash is lowered the unwinding of the cord winds the spring. All the parts of this sash balance are readily accessible for adjustment or repairs.

Men and Other Animals as Seed Carriers.

The "tick seed" (*Desmodium*) is a good example of a seed which the mother plant provides with means of clinging to almost any passing object. The pods of the "tick seed" are almost completely covered with small hooks, which catch hold of the clothing or the wool and hair of animals, and are carried away from the place where they were produced.

The genus *Bidens* of the sunflower family furnishes very familiar examples of seed distribution by animals. Each seed covering is provided with two stout prongs, which are barbed, with the points of the barb extending backward from the point. These prongs pass easily into clothing or the coverings of animals, but are not readily detached. These "pitch forks," as they are commonly called, have no other use for their barbed outgrowths than to aid in the distribution of the seed, and sheep, dogs, and other animals are employed in carrying the young Bidens from place to place. The burdock furnishes another fine illustration of a natural provision on the part of the mother plant for a distribution of her offspring by passing animals. The burr, containing many seeds, is surrounded by a multitude of sharp hooks, and by these the whole burr is closely fastened to man and beast. The reader will call to mind instances where cattle, sheep, dogs, and even horses have become partially covered with these closely clinging burrs. In this way the burdock seed may be carried from one State to another. Strange plants are frequently found near mills in which wool is carded and prepared for weaving. The wool comes in the fleece from various parts of the country, and perhaps from other countries, and the seeds clinging to the wool are separated, thrown out as refuse, and afterward, finding suitable ground, germinate and produce plants new to the locality. The smaller animals, and those not domesticated, as the rats and mice, act their part in this grand scheme for the spreading of the seeds of plants. Cotton is perhaps the most familiar vegetable product which is produced as a means of seed distribution. The human family is greatly blessed by this provision on the part of the cotton plant. Each cotton seed is completely inclosed in a tuft of fine hairs, by means of which the seed is easily and quite securely fastened to a person's clothing or to the coverings of animals.

The fowls of the air are active seed bearers, especially those of small berries or pulpy fruits with small and hard seeds. The indigestible covering preserves the seed, while the exterior soft parts with their usual high color insure their being eaten. In this way the seeds of the blackberry, raspberry, currant, cherry, and a host of wild berry bearing plants have their seeds carried far and wide.

The Sparrow Nuisance.

The English sparrow, which has become so prevalent throughout the country, has demonstrated itself to be a first-class nuisance, fighting and squawking continually among themselves, and driving robins and other domestic birds from their usual haunts. How to get rid of the ubiquitous sparrow is now the question. In Germany and England the sparrow is a game bird, and is much sought after for pies, which are highly prized. By all means, says one of our contemporaries, put him on the list of game birds in this country, and make the season from January 1 to December 31. In addition to this it would be well, suggests the same authority, to offer rewards for methods of popularizing the sparrow as an article of diet.

Steam Whistles.

A correspondent of the *Railroad Gazette* recommends a steam horn instead of a steam whistle. He says that "as a general rule the steam whistle must be very powerful to be effective within half a mile. Now, if instead of a whistle a horn were to be used, the gain in useful effect would be great, while the disagreeableness of tone would be much, if not entirely, reduced. The form of such a horn with a mouthpiece or forcing tube would be extremely simple, of inconsiderable expense (less than that of the ordinary whistle), and instead of the screeching sound of the latter, it would yield the mellower tone of the modern tuba or cornet-a-piston, to which we suppose most persons will not object." There seems to be a good opportunity here for some ingenious person to exercise his inventive talents.

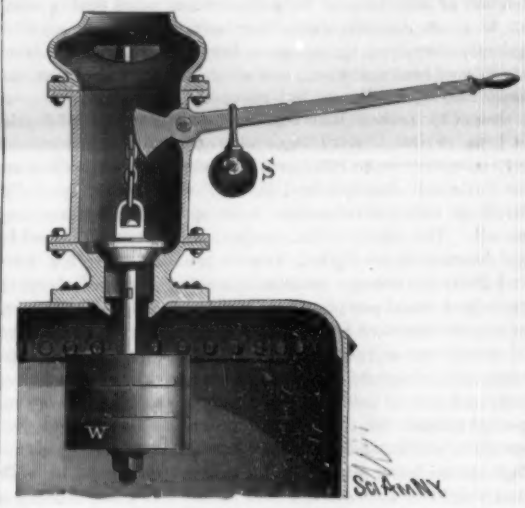
NEW SPANISH WAR STEAMERS.

Our engraving, from *La Ilustracion*, of Madrid, represents one of four new gun boats, all alike, and now in progress of construction in Spain. Their names are the General Concha, the Mgallánes, the Elcano, the General Lezo. The General Concha was launched last September, and is represented in our picture. These ships have a length of about 160 feet, beam 25 feet, displacement 524 tons, 600 horse power. Ordinary armament, three Hontoria guns; and on special occasions they will carry a large gun at the bow.

IMPROVED SAFETY VALVE.

The safety valve represented in the annexed engraving combines in one device both the lock form of valve and the open or adjustable one, with the advantage that, being the valve in ordinary use, it is not so liable to stick as is the ordinary lock valve, which operates only under excessive pressure, and in some cases fails to act altogether.

This improved valve employs a lever of a different order than the one ordinarily used, and there is a slack connection between the lever and the valve. The fulcrum of the lever is intermediate between the power applied and the weight to be raised, and the valve is inclosed within a lock-box or case, as also is its slotted rod or chain connection with the short arm of the lever. The valve itself is loaded, either



GREGORY'S SAFETY VALVE.

above or below, with a maximum weight, W, that corresponds to the extreme pressure the boiler should carry. Arranged upon the longer arm of the lever, which is exposed for control of the engineer, is an adjustable weight, S, for regulating the valve to blow off at any less pressure than the maximum one. Any extra weight put upon this arm of the lever eases the lift of the valve, which accordingly cannot be overloaded, and any propping up of the lever simply operates to slacken the connection between the lever and the valve, that is left free to act under its maximum load, W. This valve has never been patented, but was invented, as we are informed, by Mr. A. Gregory, of Newark, N. J., over thirty years ago, who has shown us a drawing made at that time which exhibits several modifications of the invention.

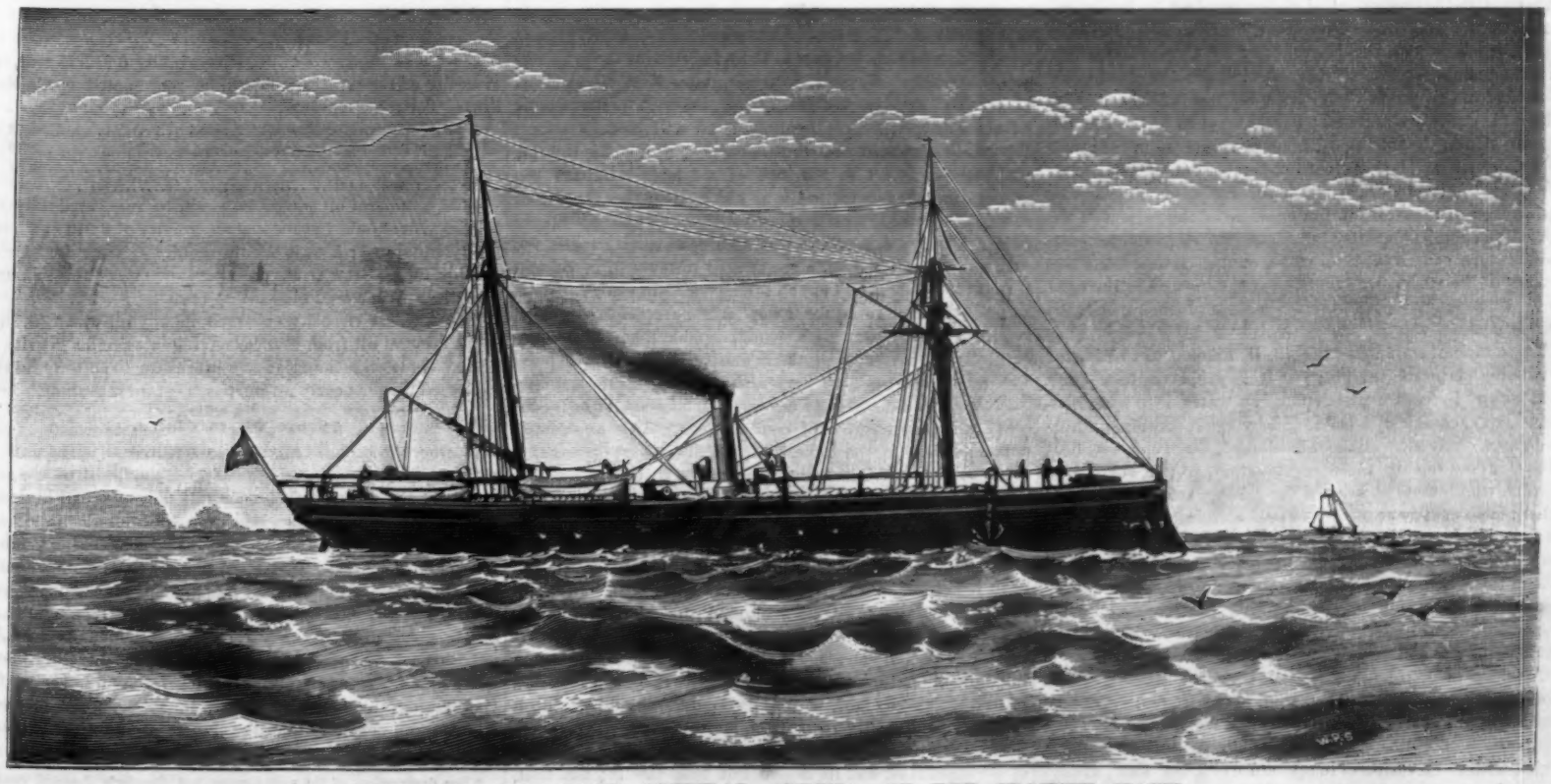
Steel for Cutting Tools.

C. Reichel, of Berlin, gives the results of many years of observation on the preparation of steel for tools in the *Zeitschrift für Instrumentenkunde:*

First, the steel must only be heated to dark red, which is the temperature at which a film of soot burns off.

Secondly, the heated article must be carefully protected from oxidation, hence a flame rich in carbon must be used, and the immersion be done as quickly as possible, so as not to keep it long in the air.

Thirdly, water used for hardening must be free from alkalies and carbonate of lime.



THE NEW GUN BOAT GENERAL CONCHA, OF THE SPANISH NAVY.

Petroleum as Fuel.

Since the discovery of the oil springs in America, various efforts have from time to time been made to introduce petroleum as a fuel for steam boilers and general heating purposes; but notwithstanding that the subject has been taken in hand by both British and foreign governments, as well as by private individuals of considerable influence and ability, it is a fact that not only has no practical progress been made in the use of liquid fuel, but that in those cases where it has been tried and experiments carried out with the best results as regards evaporative efficiency, the installation has been abandoned, and a return made to our old and much abused friend coal. The reason for this is not far to seek, and consists in the fact that the cost of evaporating a given quantity of water by means of heat produced by the combustion of petroleum so far exceeds that when coal is used, as to much counterbalance any advantages that may be gained; always excepting those few countries where from scarcity of coal and wood, and abundance of petroleum, the latter fuel is found to be the cheapest.

One of the earliest investigators into the merits of liquid fuel was Sainte-Claire Deville, who carried out a series of very extensive experiments with a couple of locomotives on the Paris and Strasbourg Railway, which were specially fitted up under his direction with appliances for burning the oil. The results of these experiments were published in the *Journal* of the French Academy of Sciences for 1868 and 1869; the average evaporation being given as about 11 pounds of water per pound of fuel. In the United States, commissioners were appointed to specially consider the value of petroleum as fuel on board steamers, a sum of $5,000 being appropriated for making the necessary tests; but after long and careful trials, the Secretary of the Navy finally reported against its use, on the grounds that convenience, comfort, health, and safety were against it, the only advantage shown being a not very important reduction in bulk and weight of fuel carried. As far as our own country is concerned, the whole subject was brought before the Institution of Civil Engineers in 1878 by Mr. Harrison Aydon, in a comprehensive paper dealing with the matter historically, and in which the results of a great number of experiments made with different forms of boilers under various conditions, and with several kinds of burners, were given. In this paper the use of liquid fuel was strongly advocated, and it was shown that with burners on Mr. Aydon's system, in which superheated steam was used for evaporating the oil previous to combustion, and in which a jet of steam was associated with the burning fuel, perfect combustion without smoke was obtained, with an evaporation almost identical with the full calorific power of the oil. Other burners, on somewhat different plans, but all employing the use of steam in combustion, gave almost similar and equally satisfactory results. In view of this it is somewhat surprising to read in a pamphlet recently published in order to puff up the value of "water gas," produced by the process of Dr. C. Holland, to which our attention has been directed, that "how to use petroleum or mineral oil in a direct manner as fuel with good economy and effect has never been discovered." Further, "that if such a direct way to burn petroleum had been discovered, we should have been much later in learning, if at all, how to make the most effective and economical fuel ever known, by using petroleum as a resolvent of water; and thus reproducing the enormous heat which the constituents of water—oxygen and hydrogen—create in reuniting. The effective power of the combustion of oxygen with hydrogen has been shown by the experiments of various standard authorities to be 50 per cent greater than that of the combustion of the same quantity of oxygen with the equivalent of carbon required for its separation from the hydrogen of the water." This, as is afterward stated, has been learnt and applied by Dr. C. Holland, whose process is thus described: "Not a particle of oil or of oil vapor is burned in this process after its operation is fairly started. The oil is entirely combined with the oxygen of the water—steam—within the retorts, without a single atom of atmospheric oxygen. The constant temperature of the fire chamber keeps the retorts hot enough for the disengagement of the oxygen of the steam in the presence of the carbon of the oil. The chemical affinity of these two elements at such temperature causes them to unite, and so releases the hydrogen of the steam, which issues at the burners in the most powerful combustion, producing, instead of smoke, only the purest aqueous vapor."

These modest statements practically amount to a claim for producing perpetual motion; for it is proposed to acquire heat energy by continually separating water into its constituents, oxygen and hydrogen, and by again combining these two gases, their separation, it is alleged, absorbing less heat than is given out in their combination, so that there is a surplus which may be utilized for raising steam or for any other purpose. The absurdity of such a claim will, of course, be apparent to any engineer who gives the matter a moment's serious consideration; but as there are doubtless many to whom the whole subject is strange, we propose to briefly consider the circumstances attending the combustion of mineral oil, and to make a concise comparison between its calorific power and other properties and those of coal.

A pound of petroleum may be taken as consisting of 0·85 pound of carbon and 0·15 pound of hydrogen, which, if burnt direct to carbonic anhydride and water with the exact equivalent of atmospheric air, would produce 22,700 heat units, with an elevation of temperature of 5,484° Fah., always supposing that combination could take place at this temperature, which is doubtful. This supposes a thermal value of 17,000 units per pound of carbon, and 55,000 units per pound of hydrogen, the former being somewhat higher than is generally allowed for carbon in the solid state, and the latter a little lower than is taken for gaseous hydrogen. Assuming now that instead of being burnt directly with air, the petroleum is first heated in a chamber in contact with steam, to such a degree that partial combustion takes place, the oxygen of the steam combining with the carbon of the oil to form carbonic oxide, while the hydrogen of the steam, as well as of the oil, is set free. In this case the 0·85 pound of carbon will combine with 1·18 pounds of oxygen from 1·27 pounds of steam, giving out 5,950 heat units, and setting free the 0·15 pound of hydrogen in the oil as well as 0·14 pound with which the oxygen was associated in the form of steam. The separation of this steam into its constituent gases is only effected by the expenditure of heat, as much heat being absorbed as is given out in its formation, so that to supply the 1·13 pounds of oxygen, 8,680 units must be communicated from the outside. After this partial combustion there remains 1·98 pounds of carbonic oxide and 0·29 pound of hydrogen, which on issuing from the retorts through suitable nozzles and meeting a proper supply of air would be burnt to carbonic anhydride and water, producing 25,430 heat units. Adding to this the 5,950 units from the formation of carbonic oxide, and deducting the 8,680 units required for the dissociation of the 1·28 pounds of steam, there is left a net total of 22,700 units as the result of the complete combustion of 1 pound of petroleum, which is precisely the same value as was found in the case of direct combustion with air. It will thus be seen that no advantage as regards increase in heating power is obtained by the use of steam. In practice, however, there seems to be an advantage of another kind, inasmuch as the steam is found to promote the combustion by bringing about a proper intermixture of combining particles, so preventing the formation of the smoke which nearly always accompanies combustion with air alone, and which is the cause of considerable loss from waste of carbon and reduction in the efficiency of the heating surfaces. Steam also promotes the draught, and so permits of a lower temperature of escaping products than when the draught is entirely dependent on the chimney. Taking this temperature at 300° Fah., and assuming the temperature before combustion at 60° Fah., each pound of petroleum will give 21,460 available units of heat, which is equivalent to an evaporation of 22·21 pounds of water from and at 212° Fah.

Turning now to coal—which we may take as being composed of 83 per cent of carbon and 5 per cent of hydrogen, the remainder being chiefly ash, with a little oxygen and nitrogen—and taking thermal values of 14,500 and 50,000 units respectively for 1 pound of solid carbon and hydrogen in the condition in which it exists in coal, we find that the combustion of 1 pound to carbonic anhydride and water will give 14,535 units, while if only the exact proportion of air be admitted, the rise in temperature would be 4,845° Fah. Allowing an initial temperature of 60° Fah., and a temperature of 500° Fah., for the escaping products, this represents an evaporation of 13·5 pounds of water from and at 212° Fah. The evaporative efficiency of 1 pound of coal to 1 pound of petroleum is, therefore, as 1 to 1·64 under the conditions taken; but as with petroleum the admission of air to the combustion chamber can be controlled with much greater exactness than with coal, there is less loss from the cooling effect produced by more air entering than is really necessary to support combustion, and allowing for this, we are disposed to place the possible actual efficiencies as 1 to 2. With this as a basis it is easy to arrive at the relative cost of the two fuels. Taking coal at 15s. a ton, the value of 100 pounds weight will be $8\frac{1}{16}$ pence. Crude petroleum is at present worth 6d. a gallon, but is not fit to be used as a fuel without distillation. We will, however, take it at 6d., and as the specific gravity is 0·800, water being 1·0, 100 pounds weight will occupy 12½ gallons, and will cost 75 pence. The relative costs of coal and petroleum, weight for weight, are, therefore, as 1 to 9·3; but as we have admitted the evaporation efficiencies to be as 1 to 2, it makes the actual cost of evaporating a given quantity of water with petroleum to be 4·63 times as much as it is with coal.

One of the chief advantages alleged in favor of petroleum is that it would occupy much less space than coal, and that ships could therefore take away a much greater supply of fuel than at present, which would enable them to remain longer at sea, and obviate the necessity for coaling depots. This advantage has been very much overrated, for with petroleum of specific gravity 0·8 equal spaces would be occupied by equal weights of coal and oil. This allows 50 pounds weight to the cubic foot, which is about correct for north country semibituminous coal when heaped, Welsh and Scotch being heavier, and therefore making the comparison less favorable to petroleum. It would appear, then, that taking into account the calorific power of the two fuels, a given amount of storage room would be just twice as efficient if petroleum was used as in the case of coal. In addition to this there must be reckoned the reduction in the number of stokers, which is no doubt a very important feature, especially at sea. Against this, however, the highly inflammable nature of the oil must always be considered a source of great danger, as well as the difficulty in storing it in vessels sufficiently away from atmospheric action. There is also the difficulty which may arise from the clogging up of the apparatus, and its destruction from the intense heat. The high furnace temperature is also exceedingly apt to produce priming, though this could be guarded against to some extent; but we believe it is entirely owing to excessive priming that such absurd reports have been made as to the evaporative power of petroleum, some experimenters having recorded as much as 35 pounds of water per pound of fuel, whereas we have seen that 22·21 pounds is the maximum amount attainable, even when only the exact supply of air required for combustion is admitted.

That petroleum can under some circumstances become an efficient and economical fuel is a proposition we are not disposed to dispute; for instance, in Russia, where, from the scarcity of wood and other fuel, mineral oil has been very advantageously used. What we do contend is, that excepting under such special conditions as are not likely to obtain in England and other principal countries in Europe, or even in the United States, which is comparatively close to the oil wells, petroleum is a much more expensive fuel than coal. It is well for us also to state again, that there is no difficulty in burning mineral oils, notwithstanding what may be said to the contrary by anxious inventors. It is too late in the day to claim any very special advantage in the use of superheated steam. This has been done over and over again, and though we do not pretend that one form of burner may not give somewhat better results than another, there is certainly little prospect of any startling discovery being made which is at all likely to enable petroleum to compete commercially with coal as a general fuel for raising steam. What is really wanted is a reduction in the price of the oil, but we think that not even the prospective new sources of supply, when made available, will effect much in this direction.—*The Engineer.*

Variation in Oils of the Same Density.

In the study of mineral oils it is customary to classify them, in part, according to their specific gravity, yet it must have occurred to every one that two oils which have the same density are not necessarily identical. The various oils are prepared by distillation, and none of them are simple compounds of definite composition, but each is a mixture of, we know not how many, different oils. As the distillation proceeds the gravity increases, and as dangerous oils are succeeded by safe oils, so illuminating oils are followed by lubricating oils, with no well marked boundary or separating line between them.

R. Krause has introduced a new factor into the problem of testing and distinguishing oils, viz., their viscosity or consistency. He finds that oils which have the same specific gravity at the same temperature may differ widely in viscosity. The author determined the time required by the same quantity of the different oils to flow out of fine tubes, and compared this time with that required for the same quantity of rape seed oil to flow from the same tube.

The experiments were made upon four samples of oil, each having the specific gravity of 0·883 at 60° Fah., but from four different places, viz., Sachs-Thuringen, Oelheim, Scotland, and Pennsylvania. The first named is obtained by distilling a light brown, friable, bituminous brown coal; the Scotch oil, by the distillation of a bituminous shale; while the oil from Oelheim, like that from this country, is obtained by the distillation of crude petroleum. The method of preparing each of these is well known.

The time required for 25 c. c. of each oil to flow from the viscosimeter, at 60° Fahr., was as follows:

Sachs-Thuringen paraffine oil	2 m. 50 sec.
Oil from Oelheim petroleum	5 " 35 "
" " American petroleum	9 " 10 "
" " Scotch shale	9 " 45 "
Rape seed oil	32 " 25 "

From this we see that the German oil is twice as thick, and Scotch oil more than three times as thick and viscid as the paraffine oil of Saxony.

If we take rape seed oil (specific gravity 0·912) as unit, the viscosity of the mineral oils will be represented by the following decimal fractions:

Sachs-Thuringen paraffine oil	0·088
Oelheim petroleum	0·189
American petroleum	0·282
Scotch paraffine oil	0·301

That a mineral oil should be equal to rape seed oil as a lubricant it should have a specific gravity of 0·910 and a viscosity equal to 1; *i. e.*, it should require as long for 25 c. c. of this oil to flow from the viscosimeter* as for the same quantity of rape seed oil.

The greatest viscosity observed in any oil was 2·45, in a thick mineral oil from Russia, having a specific gravity of 0·910. This oil is superior as a lubricator to cotton seed and rape seed oil for nearly all purposes.—*Chem. Zeitung.*

Aurora Photo Plates.

Photographic plates are now so sensitive that the flash of the lightning's stroke may be caught, the flight of the cannon ball, the spokes of the rushing locomotive wheel, the feet of the fleetest horse, and even the dim gleams of the nebulæ. But there is one subject, it seems, that is too fine for the most sensitive of the best plates—the aurora borealis. Dr. Tromholt, the famous Norwegian philosopher, who makes it his special study, has made many attempts to obtain a negative of the aurora, but without success. An exposure of seven minutes on the most sensitive dry plates gives him no trace of an impression. It will never do for the photographer to be beaten in this shabby manner. Plates more sensitive than the aurora are now wanted, and we doubt not will soon be forthcoming.

* For description of the viscosimeter, see *Dingler's Journal*, ccxix., 163.

Correspondence.

The Locomotive Whistle.

To the Editor of the Scientific American:

I can verify the statement of Mr. David L. Ellis. Our mill is in Atlantic County, N. J., six miles from the nearest station, seven and a half miles to the station above, and nine miles to the station above the latter. On the approach of a storm or in damp weather, we can clearly hear the whistle of the locomotive at all three stations; and standing in the mill door, with the railroad time table in one hand and watch in the other, we can verify the time and tell if the train is late or on time. This has been frequently done, and the whistle has been heard above the station (nine miles) to "clear the track," "back," "go slow," etc. In dry weather we do not hear it. It is to our hands a "sign of rain," to hear them "shifting cars" at the station nine miles away. I have frequently heard the whistle after leaving the station several minutes give the "put on brakes" signal, which would be at least ten miles from where I stood.

W. E. F.

Philadelphia, Pa., Sept. 13, 1883.

How to Destroy the Woodchuck.

To the Editor of the Scientific American:

In your journal of Sept. 8, 1883, I observed an article on the woodchuck and the action of the New Hampshire Legislature to exterminate the pest. Mr. George O. Chamberlain, a farmer residing at Cedar Hill near this village, had on his sand farm an army of woodchucks, and for years they took more than a tenth.

Mr. Chamberlain extirpated them by the following device: After they had retired for winter quarters, and the surface of the ground had been deeply frozen, he chose a cold night and shut up all the holes with earth, pressing it down so that the entrance and exit were hermetically sealed, excluding the air. With all their strength they could not dig out of their prison, and died as in the "black hole of Calcutta;" not one came out alive. This plan is better than a bounty or "drowning out."

J. P. BUTLER.

Saratoga Springs, N. Y., Sept. 14, 1883.

The Electric Age.

To the Editor of the Scientific American:

Any one who was a close observer at our great Centennial Exposition of 1876, can but discern the wondrous advancement in electric science in the past seven years. Comparing the faint show of 1876 with the three thousand or more of the Edison interior lights of the Louisville Exposition, lighting as it does every part of the vast buildings with a soft, mellow light, by which all the shades of color are as discernible and the smallest needle's eye as conspicuous as by noonday sunlight. And then view the towering brilliants that illumine the entire surroundings, putting the blush upon the very face of the full moon as it peers through the rifts of snow-white clouds and sheds its dim, shimmering light, then hides away again behind its silver lining as if to say, "I am no longer monarch of night." Then step into the park; here stand two cars, much more spacious than ordinary street cars, and attached to a small machine. Pay ten cents for your ticket, take your seat, fill any place for a passenger. "All aboard!" The conductor, or engineer, or electrineer, or whatever you choose to call him, gives a little wheel a whirl, and off we go, turning and twisting around all the short curves, making a stop at the Art Gallery station; then off again, down grade and up grade; now the artificial tunnel is reached; we enter—all is darkness; but instantaneously, as quick as thought, it is as light as day by means of the same agent that is propelling you around the park at the rate of a mile or more every two minutes. Then enter again the building; see the busy sewing machine stitching away, propelled by the same subtle agent; and the submarine light under water. Contrast this, I say, with the electric show at our Centennial, and who dare dispute that we live in the Electric Age?

And we naturally ask ourselves, "Are we to utilize the waste powers of nature—air, water, and electricity—to light and warm our dwelling, cook our food?" And is electricity to become the motor of the future? Is man yet to harness all of the elements of the heavens and the earth into his service? The achievements made within the past seven years in electrical science, including the transmission of human speech by telephone, are among the most marked triumphs of scientific attainments of the age in which we live.

The Louisville Exposition is by far the largest ever held in the South. The display of agricultural machinery, implements, and tools is probably the largest and the most complete ever displayed in the world. And that of saw mills, wood working, woolen, and cotton machinery is equal to any similar show that has ever been made.

And in many departments the products, machines, and manufactures of the Southern States show them to have become successful rivals of Yankee Land. With no more "Mason and Dixon" lines to mar the fraternal sensibilities, the men of the East, the West, and of the South here unite and compare the vast products of genius and labor, where all can come and in a few days learn more of what has been done in this progressive age of scientfic and mechanical achievements than could be learned in a lifetime hunting warehouses and workshops. And the people of the entire country, by such an exhibition as this, are able to form a higher appreciation of each other, socially, scientifically, and mechanically, than could otherwise be done in a generation.

J. E. EMERSON.

Louisville, September 17, 1883.

Relief Maps or Models, and a New Vegetable Fiber.

To the Editor of the Scientific American:

Having just completed some relief maps, which in connection with a somewhat extended manuscript and several models constitute my response to the international offer, proposed by the King of Belgium, for the best "System of popularizing Geography, and developing its Instruction in Institutions of all Grades," I send you a brief statement of the material and means used for modeling these relief maps. After numerous experiments with various substances, clay, plaster of Paris, hydraulic cement, a compound recently recommended of whiting, Venice turpentine, etc., and purchasing some models in papier mache, besides obtaining estimates for models in metal, etc., it was found that for cheapness, facility in correction, and in the reception of colors, etc., before hardening, for permanence after hardening, and for striking effect, no other material tried was at all comparable to the plastic material derived from a thorough incorporation of the requisite amount of linseed oil with pure Spanish whiting; in other words, good putty of the right consistence. In the maps destined for Belgium, no one would recognize that compound as the fundamental structure, yet it is so, even in models designed to illustrate the various technical terms used in geology, such as strike, dip, synclinal axis, escarpment, talus, cañon, glacier, moraine, etc. It is true, that in the latter case plaster of Paris and small pebbles have been worked in, while in the former the colors, dusted on while the putty is in the proper condition of receptivity, conceal entirely the original material.

METHOD OF WORKING.

On a half inch board, putty in the suitable condition is rolled out thin to cover all the land, which may have been previously traced with charcoal or pencil, leaving the planed board to represent oceans, etc. The putty usually adheres, unless where thinly spread, in which case running a brush full of mucilage over the board will insure the putty to remain when pressed down.

Either the same day or even several days later, the student may correct all his outlines in detail by means of a penknife or small steel instrument made purposely somewhat shovel-shaped, but curved and running to a point. At a subsequent period, the plastic material, rolled in the hand, is laid of suitable height and extension to represent mountains and plateaus. The valleys, rivers, and lakes are then excavated, and the model is ready, if the putty has not been too moist, for the reception of colors, etc. To represent snow mountains, either plaster of Paris or zinc white may crown the summits. Should we desire to show that a mountain is an active volcano, a small amount of dry vermilion is placed in the crater. The colors, if too vivid, may be tempered by mixture with dry whiting. This is especially necessary with the artificial and cheap pigment in powder sold as ultramarine. With a short camel's hair brush the various colors are dusted on to represent the geological features, employing if desired, for easy remembrance and harmonious succession, the colors of the rainbow; various shades of red (with orange) characterizing the Paleozoic formations; of yellow (with green), the Mesozoic; of blue (with purple), the Cenozoic. The Plutonic rocks (granites, syenites, porphyries, etc.) can be well imitated by black, white, and reddish dots on an appropriate ground, metamorphic rocks by longitudinal striæ on suitable ground, as blue for clay slates, greenish for talcous, yellowish for mica slate, etc. The igneous basalts, trachytes, etc., are represented by the shades of brown, the newer volcanic being of the lighter varieties. The ocean is made by using oil with chrome green, and the lakes oil with some blue.

THE ADVANTAGES

are comparative lightness and cheapness as compared with the cast iron relief maps, capability of correction and practice for the eye, as contrasted with gypsum casts; durability and comparative safety from fracture as compared with papier mache models.

Purchasing putty wholesale in bladders, it costs only two to four cents per pound, can be kept a considerable time quite plastic; but when spread out thin, especially if we add a little Japan varnish, becomes, after some weeks or months, as hard as a board, and the models can be preserved by the student for constant reference.

Judging from my own experience, I should say that any given map, thoroughly modeled, will impress the facts, particularly orographic and geologic, with infinitely more force on the memory than the best map can effect, or even the lesson conveyed by drawing the map.

The system was tested with good results in the graded school here, by a class of boys and girls from twelve to fourteen years of age. Since then, having sent specimens to a teachers' meeting (about 300 present), the models were approved and permission asked and granted to use the system. A few months later, President Lugenbeel, of the Mitchell Normal School (Ind.), having 300 students, writes me that they have been most successful in modeling the United States on a scale 3 feet by 2 feet. That "in no case did the materials cost over fifteen cents, yet the owners of the models would not sell them for five dollars, some not for ten."

A plaster cast of Bourbon (Reunion) with its extinct and active volcanoes cost me in Rochester, N. Y., four dollars. I have since modeled from that copy at a cost of four or five cents, using a foot of pine board and a pound of putty. The colors cost usually from ten to fifteen cents per pound, and by being dusted over the surface cover a large area with a small expenditure of material. Sandy deserts are easily imitated by dusting fine sand over the putty while moist, and, where geological coloring is not desired, clay, earth, or pounded rock can be worked into the surface either with or without admixture of water.

Educational institutions will, I think, find the above system an important aid in the study of geography.

NEW FIBER FOR CORDAGE, PAPER, OR TEXTILE FABRICS.

When attending the Boston Meeting of the A. A. A. S., a member informed me that he was an importer of the raw caoutchouc material from South America, and a manufacturer of rubber goods; that he had successfully employed as a partial substitute, in the waterproofing of certain fabrics, an Asclepias, or milkweed, cultivated for him in some Western State; and had satisfied himself that, in case of a scarcity from South America of the gum from the Siphonia elastica, or similar plants elsewhere, this could be utilized to a considerable extent.

Thinking that either in case of a diminished demand for our maize, or from a desire to alternate crops, the culture of the Asclepias might be tested here and found advantageous, I examined several localities in which I knew of its growing spontaneously, and I obtained plants of very luxuriant growth, some of them six feet high, with their curious double pods often four inches long and full of silky seeds.

The Secretary of our Workingmen's Institute here, on having his attention called to the above facts, informed me that the stems of the Asclepias afforded abundance of a tough fiber; and a few days after, brought me the specimen which I inclose. It seems, judging from that small sample, a fiber of considerable length and strength, which might perhaps prove useful and profitable in the hands of those who choose to experiment upon its merits, as an adjunct to the fibers at present in use, either for textile fabrics and cordage, or for some qualities of paper.

RICHARD OWEN.

New Harmony, Ind., August, 1883.

Giant Mining Pumps.

A correspondent of the *Mining Record*, writing from Virginia City, Nevada, says the excavations for the pump station on 2,640 level of Combination shaft is making rapid progress. Some of the material for the pumps is on the ground and arriving daily, which is being overhauled, inspected, and prepared to be put in place. Mr. Charles Mathewson, the efficient foreman of the shaft, promises to have the pump in operation about the middle of December. When this is done, the water problem will be effectually settled in this group of mines, and will enable the Savage, Hale and Norcross, Chollar, and Potosi to prospect as far west, further east, and at as great a depth as any property on the Comstock, with absolute safety from flood and a greater certainty of development. No one, unless they were to personally examine the pumping appliances now in use in this shaft, can form any conception of their magnitude and power. The hydraulic pump station on the 2,400, 80 feet long, 20 wide, and 10 high in the clear, with an ell for a water tank 80 feet long, 7 high, and 10 wide, is timbered most substantially throughout with 14 x 14 inch timbers and 4 inch lagging, over 100,000 feet of timber being used in its construction. Here are the two massive double ended, double acting hydraulic pumps, regular, reliable, and noiseless, running at a speed of 4½ strokes per minute each. Although the pressure of the feed is 1,300 pounds to the square inch of valve surface, so perfect is the action of the air cushions and valve connections there is no perceptible jar. With a capacity of 5,000,000 gallons, these pumps are sending to the Sutro level, from the 2,400 west cross cut, 1,360,000 gallons, and from the 2,600 level, 1,840,000 gallons, a total of 3,200,000 gallons or 188 miners' inches every 24 hours.

The station is connected with the surface by an electric signal appliance, which makes communication instantaneous and perfect. Gauges indicate the pressure in the several columns, the variations, the speed per minute, and the work done for any interval of time. A first class fitting shop with necessary tools and vises is one of the conveniences; a cooling house one of the necessities, as the temperature of the water is 140 degrees, that of the station over 100 degrees. When the pump on the 2,640 is completed, this shaft will be able to handle 10,000,000 gallons of water every 24 hours. The Sutro tunnel discharges 8,250,000 gallons, more than 3,000,000 of which is from her own drifts and connections, thus making it possible for this shaft to handle double the quantity now handled by the combined working shafts on the Comstock.

The shaft consists of one large pump and three working compartments, every foot of which is in perfect condition. The surface machinery and hoisting engines are constructed for power, speed, and endurance. They are capable of doing all the business of the four mines, can handle the men, the timber, the material and supplies necessary in their working and prospecting, and in addition, 2,500 tons of rock, equaling 33,750 cubic feet, or the creation of a cavity in the earth's crust, 10 feet wide, 10 high, and 337½ long every 24 hours.

SAD-IRON HOLDER.

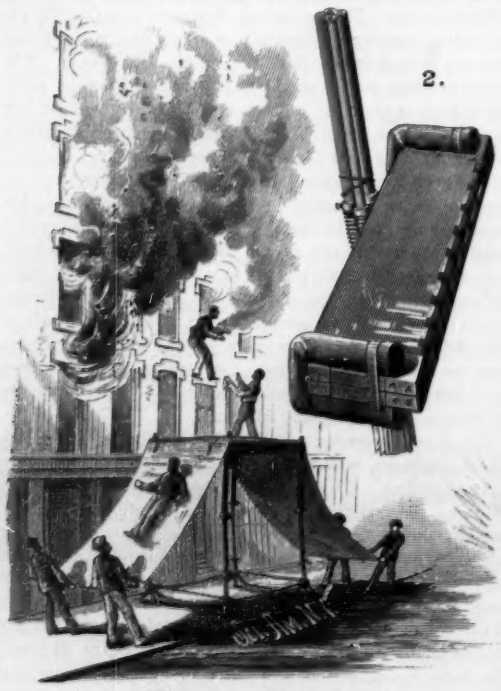
The annoyance resulting from the heat the hand encounters when grasping the old-style sadiron has led to the introduction of many devices tending to obviate this. One of the best and most recent has been patented by Mr. John O'Neil, 24? Dorchester St., South Boston, Mass.

The body of the holder consists of a pad of convenient shape to be taken in the hand, and is made, preferably, of asbestos cloth covered with ordinary woolen cloth, although any good non-conductor may be used in its construction. Beneath the holder is a metallic shield disposed horizontally between the handle and the body of the iron. A wire passes through one side of the holder, which is there narrowed and extended so that when grasped by the hand it will fold under the wire and permit the hand to go in over the shield. The ends of this wire pass through holes in the shield, and are then bent so as to pass on each side of the handle of the iron, as shown in the engravings. The holes in the shield are enlarged, so that it is free to rock on the wire as on a journal. It will readily be seen that the shield and holder may be easily detached from the iron.

O'NEIL'S SAD-IRON HOLDER.

IMPROVED FIRE ESCAPE.

The simple and efficient fire escape shown in the annexed engraving is the invention of Mr. Henry B. Church, of Grand Rapids, Mich. A stout blanket, attached to a folding frame and provided at its ends with aprons of some strong textile material, is supported upon four standards by spiral springs surrounding the standards and resting on adjustable collars. The standards are telescopic, the upper part being made of iron pipe and movable on the rod forming the lower part. A set screw passing through a collar at the lower end of the pipe clamps the pipe in any desired position on the rod. The standards have folding legs, and are held in proper relation to each other by chains. The aprons are provided with handles, by means of which they may be held in an inclined position, as shown in Fig. 1.



CHURCH'S FIRE ESCAPE.

A person escaping from a burning building jumps into the blanket, which yields with the impact of his body and arrests his downward motion without injury to himself or the apparatus. Descent is made from the blanket by sliding down the aprons, as shown in the engraving. Fig. 1 shows the fire escape in use, and Fig. 2 shows it folded.

Oil from Sunflower Seeds.

The sunflower has long been grown for its oil seeds in Russia and India, and the cultivation has been more recently taken up in Germany and Italy. The plant grows readily in most soils, but prefers light, rich, calcareous land, unshaded by trees. In Russia the seed is drilled into lines 18 inches apart, and the plants are thinned out to 30 inches apart in the rows, thus giving about 11,000 plants in an acre. The quantity of seed required for an acre is four to six pounds, and the sowing takes place in September–October, the crop being ready to harvest in February. In England it is recommended to be planted 6 inches apart and 1 inch deep, and to be earthed up when 1 foot high, requiring no subsequent attention. The yield of seed is much increased by topping the plants, and the best fertilizer is old mortar. Each plant produces about 1,000 seeds, chiefly on the main head.

Experimental culture in France gave a return of 1,778 pounds of seed, yielding 15 per cent of oil (275 pounds), and 80 per cent of cake, from an acre; but the product varies considerably according to soil, climate, and cultivation, and the average may be roundly stated at 50 bushels of seed from an acre, and 1 gallon of oil from 1 bushel of seed. The percentage of oil to seed ranges from 16 to 28; and that of husk to kernel from 41 to 60.

The Italian cultivation is confined to the neighborhood of Piove and Conegliano, in Venetia. In Russia the plant is most extensively grown in Kielce and Podolia, and the district of Birutch, in Voronej; the production of seed is now estimated at 8,000,000 poods (of 36 pounds), from an area of 80,000 dessatines (of 13,067 square yards). In Tartary and China it is cultivated in immense quantities, but no actual statistics are available. In India (Mysore) 1 acre of land gives 11½ cwt. of seed, which yields 45 gallons of oil, which is there compared with ground nut oil, and applied to the same uses. The Russian seed is expressed on the spot, and the oil is largely employed for adulterating olive oil. The purified oil is considered equal to olive and almond oil for table use. The chief industrial applications of the oil are for woolen dressing, lighting, and candle and soap making; for the last mentioned purpose it is superior to most oils. It is pale yellow in color, thicker than hempseed oil, of 0·926 specific gravity at 15°, dries slowly, becomes turbid at ordinary temperatures, and solidifies at —16° C.—*Drug Reporter.*

A Musical Electrical Wheel.

An experiment by Prof. H. S. Carhart is as follows: A disk of sheet iron was pierced with two circles of quarter-inch holes concentric with the disk, the number of holes in the two circles being thirty-two and sixty-four respectively. On one side of the disk was placed a horseshoe magnet with its poles very near the rows of holes; on the other side were arranged two corresponding induction bobbins. The circuit was completed through a telephone and either bobbin at pleasure. Upon rotating the disk rapidly, a clear musical sound was produced in the telephone, the pitch rising with the rapidity of rotation. Moreover, the bobbin opposite the circle of sixty four holes gave the octave above the other, and each gave a note of the same pitch as was produced by blowing a stream of air through the corresponding holes.

Curious Properties of Iron and Steel.

It is well known to electricians that the best steel makes the best permanent magnet. But the magnetism of steel depends on how hot or how cold the metal is. For example, steel loses its magnetism if subjected to a temperature of 100° below zero; it also loses its magnetism when heated to yellow heat; that is, between red and white heats. Soft iron, when heated red hot, is not attracted by a magnet.

IMPROVEMENT IN DUST-PANS.

It is with some difficulty that an ordinary dust-pan is held by one hand while the dust is swept upon it by the other. Every housekeeper knows this, and the wonder is that the simple and efficient device shown in the engraving was not invented before.

This improvement enables the sweeper to hold the dust-pan by hand or foot; but the user will not be slow in making a choice as to which way is preferable. Holding the dust-pan by foot enables the sweeper to stand upright, a position which permits of readily gathering all of the dust in the vicinity of the pan, using the broom with both hands.

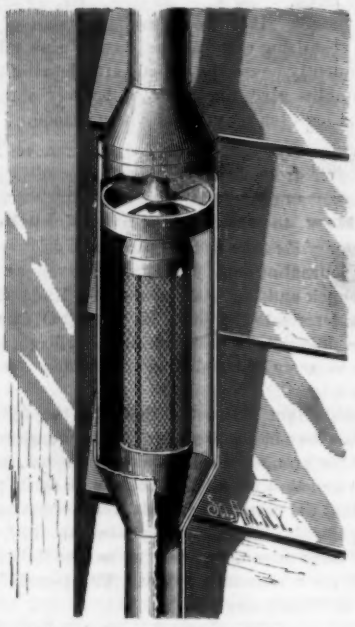
This dust-pan is made of the usual size and shape, and with the patented appliance is arranged so that the pressure of the foot causes it to adhere closely to the floor, so that the dust is swept and retained upon the pan instead of passing underneath it. It can be moved easily around the floor with the foot, the dust remaining on the pan. There is no solder used in its construction, consequently there is nothing to prevent it outlasting the ordinary dust-pan.

A frame corresponding nearly to the shape of the dust-pan is formed of band iron and secured to opposite sides of the pan, and at the back it is attached to a foot piece provided with a rest, which touches the floor, and has a horizontal arm extending toward, and secured to, the back of the dust-pan. The engraving shows so well the manner of using this device that no further description will be required.

This useful invention has been patented by Mr. William M. Valentine, of Glen Cove, L. I., who will furnish any further information that may be desired.

IMPROVED FILTER.

This filter, or strainer, may be attached to rain water conductors, so that the water from the roof will have to pass through the filter before entering the cistern, and by this means be relieved from bugs or other obnoxious matter which lodges in a dead water receptacle, so that the flowing water does not come in contact with them. The case is formed of sheet metal and has a transverse section about twice that of the conductor. To the lower end is fitted a nipple by a suitably shaped reducer, and to the upper end is fitted another nipple by a reducer to which is attached a third nipple fitting closely but detachably in the upper end of the tube so that the filter may be opened and closed when required. Within the tube is arranged a short section of wire gauze tube of about the same size as the conductor, and ribbed inside with wires to prevent its collapsing. To the lower end of the wire tube is attached a slightly tapered nipple which forms a tight but detachable connection with the lower end of the case. The upper end of the wire tube has a taper cap which closes the end to the water, and which is centered in a spider frame that holds the upper end of the tube in position. Between the lower nipple on the wire tube and the case is an annular pocket in which all matter separated from the water by the gauze falls. The filter may be connected to any part of the conductor or to the cover of the cistern.



JAMES IMPROVED FILTER.

The invention has been patented by Mr. Samuel James, of Lebanon, Missouri.

VALENTINE'S IMPROVED DUST-PAN.

Amber Dressing for Silk Goods.

Thummel, of Berlin, dissolves one pound of amber in two pounds of chloroform and applies this solution to the silk with a sponge or brush. The goods are next dried in a drying chamber and the chloroform recovered. They are then passed between rollers heated from within, which imparts to them a remarkable softness and elasticity.

Pain as a Storm Indicator.

The friends of Captain Robert Catlin, United States Army, are aware that he has for some years been serving as an animated barometer, to determine problems with reference to the relations of pain to weather, suggested by that eminent specialist in nervous disorders, S. Weir Mitchell, M.D., of Philadelphia. Captain Catlin has just published a report on his case, which was read before the College of Physicians of Philadelphia, June 6, 1883. In an introduction to this Dr. Mitchell specifies some of the circumstances which peculiarly fitted Captain Catlin for the service he has undertaken in the cause of medical science. In the first place, he is the victim of traumatic neuralgia, resulting from the loss of his foot, crushed in battle by a round shot, in August, 1864. Aside from the pain resulting from this mutilation, and which has been felt at intervals ever since in the lost foot, the observer is in admirable health; "his attacks are so definite as to coming and going as to create little difficulty in this direction, and from a former position as instructor in certain scientific branches at West Point he is well qualified by training to pursue this difficult study." "I may add," says Dr. Mitchell, "that I never knew any man more free from unwholesome attention to his own ailments;" and we may add that we never knew of a man who bore his burden of pain with more cheerful resignation and philosophy.

That this burden is by no means a light one is shown by the fact that the total amount of pain for the eight years ending on January 1, 1883, was 12,944 hours, or nearly one fifth of the time. This is Captain Catlin's calculation, but as he is free from pain during sleep, the proportion of pain during his waking hours is more nearly one-quarter. The winter months, it appears, hold the advantage as pain producers, and the proportion while the sun was north of the equator was 6,783 hours against 6,161 hours while it was south of the equator. March has the lead among the months, January being a close second, and November, December, May, February, April, August, October, September, July, and June following in this order. The average duration of pain was found to be greatest in February, 20·8 hours, the average for the whole time being 18 97 hours. February is one of the coldest, if not *the coldest*, of months, and contains probably the greatest barometric fluctuations of any month in the year; low temperature and high barometer producing pain, and extreme barometric undulations extending its duration.

As the result of the observation of sixty well defined storms, through ten consecutive months, it appears that storms announce their coming by the twitching of Capt. Catlin's nerves when the storm center is at an average distance of 680 miles, ranging from 200 to 1,200 miles. "Storms from the Pacific are felt the farthest off, very soon after crossing the Rocky Mountains. Those which move along the coast from the Gulf of Mexico are associated with neuralgia not quite so intense, and are not felt as a rule until within the average neuralgia distance." Should the pain be on a day of intermitting rain, it takes on an additional activity just before the increasing shower, and continues twenty to forty minutes; this will sometimes happen four or five times in twelve hours. Each little increment of pain seems to bear about the same relation to the showers as the main attack bears to the storm. Eating a meal hastens an attack and intensifies it when on. Eating, for example, at 8 A.M. brings on at 9 A.M. an attack not due until 10 o'clock. There is an ebb tide of pain just preceding meals, and storms coming within range during the early and the middle sleeping hours do not ordinarily arouse their victim, but delay their attack until sleep becomes less profound, thus following the ordinary rule that a victim of pain does not experience an attack until after a brief release from the influence of the anæsthetic sleep. Intense auroral periods are also believed to produce the pain.

As to treatment, Capt. Catlin says: "There has been no treatment in a medical way of late. I have had good health, take a great deal of exercise, but in a rather irregular way; my appetite is always good and I sleep well, except when the disturbance of neuralgia interferes. Physical exercise, nutritious food (have found milk most fattening of all), and light, agreeable occupations are, I found, the best regimen for a neuralgic subject."

Diagrams illustrating the relation between neuralgic pains and the barometer accompany this brochure, which, in the opinion of that competent authority, Dr. Mitchell, constitutes a most valuable contribution to the strict science of medicine. It is unfortunate that any officer should be subject to such an experience as Capt. Catlin has had for nearly twenty years; it is fortunate that, finding no escape from it, he should have the patience and zeal for science which have prompted him to make his own experience available for the benefit of other sufferers.—*Army and Navy Journal.*

PYRETHRUM, OR CHRYSANTHEMUM CORYMBOSUM.

This is a robust herbaceous plant with elegantly cut foliage and white and yellow flower heads, known also in gardens as *Pyrethrum corymbosum*. Under cultivation it grows about 4 feet high, and probably higher in rich soil. It is as hardy and persistent as the allied species, *C. Parthenium*, syn. *Pyrethrum parthenium*, of which the Golden Feather is a variety. In a wild state it grows from 1 to 3 feet high, and it is a common plant in Central and Southern Europe, ranging from Portugal to Switzerland, Austria, and Turkey. Our illustration, which is from the *Gardener's Chronicle*, was taken from a plant in the herbaceous ground at Kew, where we recently noticed it as the best and most effective of its near allies.

The insecticide and insectifuge qualities of the dried and finely powdered flowerheads of different species of *Pyrethrum* and the harmlessness of the powder to man, to other animals, and to plants, have long since been known. Used against various household pests, under the names "Persian insect powder" or "Dalmatian insect powder," it has hitherto been put up in small bottles or packages and sold at high prices. The so-called Persian powder is made from the flowers of *Pyrethrum carneum* and *P. roseum*, while that from *P. cinerariæfolium*, a native of Dalmatia, Herzegovina, and Montenegro, is more generally known as Dalmatian powder. Some interesting experiments made during the past year on different insects by Mr. William Saunders, of London, Ontario, show that the use of this powder may be satisfactorily extended beyond the household, while a series made by Professor Riley in the summer of 1878, with the same powder on the cotton worm, showed it to have striking destructive powers, the slightest puff of the powder causing certain death and the almost instant dropping of the worm from the plant. Repeated on a still more extensive scale the present year at Columbus, Texas, the powder proved equally satisfactory in the field.

Here, then, we have a remedy far exceeding any other so far known in efficacy, and harmlessness to man and plant, and the only question has been to reduce its cost. Mr. Milco, a native of Dalmatia, has been cultivating the *P. cinerariæfolium* in California in constantly increasing area for the past three years, and deserves great credit for his efforts in introducing it. The insect powders made from the California grown flowers have proved to be very effective. In SCIENTIFIC AMERICAN SUPPLEMENT No. 218 will be found an interesting and instructive article on the subject of insect powders.

THE INSECT POWDER FAMILY.—CHRYSANTHEMUM CORYMBOSUM: FLOWERS WHITE.

Construction of Induction Machines.

Dr. St. Doubrava contributes the following note upon the principle and construction of induction machines to the *Journal* of the Vienna Electrical Exhibition: In 1831 Faraday enunciated the following general law: "When a conductor moves in a magnetic field in such a manner as to cut the lines of magnetic force, a current exists in the conductor; when it moves parallel to the lines of force, there will be no current." In induction machines the space between the magnetic poles is generally understood by "magnetic field." When one pole is positive and the other negative, the lines of magnetic force run parallel to the line joining these poles, thus $+ P = - P$; but between like poles the lines of force are perpendicular to the line joining the poles, thus $+ P \parallel + P$.

Upon this general law Faraday constructed his first magneto-electrical machine, as a laboratory experiment. It consisted of a copper disk revolving between the poles of a powerful steel magnet, or electro magnet. The axis was connected by a conductor with the periphery. The direction of the current was either from axis to periphery, or the reverse, according to the direction of rotation and the polarity of the magnet. In all induction machines subsequently constructed, up to the Pacinotti-Gramme and Hefner-Alteneck machines, spools of wire (helices) were made to approach and recede from the magnetic poles, so that they were alternately in and out of the magnetic field, causing a considerable loss of power.

The Faraday disk embraces the fundamental principle of all induction machines for constant currents. To prevent the opposite currents in different parts of the disk from neutralizing each other, it is constructed in radial segments, which are isolated from each other. The periphery of two opposite segments of the same disk may be joined by a wire, while the circuit may be completed by sliding contact with the axis.

Two such disks can be arranged upon the same axis in such a manner that currents may be set up in opposite directions in the radial segments corresponding in position, when both disks rotate in the same direction. By connecting the peripheral and axial end of every radial portion, we obtain the principle of the ring inductor of Pacinotti and Gramme, in which the two external side surfaces of the wire windings correspond to the two disks. The iron core of the inductor increases the intensity of the magnetic field.

Native Woods for Decorative Purposes.

A writer in the *Railroad Gazette* gives some ideas about our native woods and their uses that may be of value to our mechanics. He says that white wood is valuable because it remains where put, notwithstanding the fact that its surface is perhaps as easily affected by water as almost any wood. In Virginia there are tracts formerly known as the "Wild Lands," in which much fine forest remains, tracts where the tulip poplar, or the white wood, shows trees that will square two feet for sixty feet of length, and where the beech, oak, the hickory, and the sugar maple have never been touched. One of the finest tracts of the much used cherry tree is found along the eastern edge of the outcroppings of the coal measures of the northern part of this region. Those who have been accustomed to see miserable, caterpillar-eaten specimens of this tree, would be surprised by the splendid trees found growing in these forests—trees three and four feet over the stump and sixty feet upward before reaching a limb.

Carrier Ravens.

Successful experiments have lately been made at Coblentz in the training of ravens as carrier birds in place of pigeons. The latter are more subject to the attack of birds of prey than ravens. The trained ravens were made to fly a distance of forty miles, and their performances gave much satisfaction.

A New Test for Portland Cement.

Notwithstanding the enormous consumption of Portland cement at the present day, and the perfection to which competition and the demands of exacting engineers have brought the manufacturing processes in the hands of the leading makers, it is yet by no means certain that the essential qualities of good cement are generally understood. Portland cement has always shared, in some degree, the feeling with which experienced constructors have been accustomed to regard steel—admiration alloyed with no little unexpressed distrust. The reason for this feeling is not far to seek. It may be found in instances of the more or less mysterious failures in the employment of cement concrete, which have occurred at some time in the experience of all users of the article. It speaks well for the innumerable advantages of cement that these mishaps—vexatious and costly as many of them have proved—have not checked its advancement in popularity, but have, at most, inspired sufferers with the determination to find out their mistake and escape similar troubles in future. Cement has in this respect the advantage over steel that it offers every imaginable facility for the severest tests before being used. The familiar gray powder—which, by the addition of water, first becomes mud, and then assumes the consistency and hardness of stone—may be analyzed, gauged, sifted, examined microscopically, weighed, etc., with the object of ascertaining precisely what kind of stone it will make. Yet to this day it is not settled how to so treat the powder that indications may be expeditiously obtained of the qualities that will attach to it long after it has been mixed and used. And, in view of the absolute necessity that the user should be satisfied on this point respecting every consignment of cement that passes through his hands (perhaps to the extent of thousands of tons for one job), the importance of testing becomes sufficiently obvious.

The test of strength that is generally adopted in England for Portland cement is exclusively one relating to the cohesion of a section of the material—neat, or mixed with a definite proportion of sand—under a tensile strain gradually but quickly applied. The earlier testing machines were very rough, and exposed the briquette to much preliminary jarring before it was finally broken. It is not improbable that the higher resistance recorded of cement in modern use, in comparison with much that was formerly sold, is due in a great measure to the steadier action of the most improved testing machines. There is, moreover, great art in preparing the briquettes in strict accordance with any ordinary method; and even then the behavior of the test pieces is frequently eccentric. It has been suggested that a more rational way of testing a building material chiefly intended for use in large masses—as in walls, buttresses, etc.—would be to ascertain its resistance to crushing, rather than its tensile strength. For this purpose cement is mixed with a regular proportion of sharp sand and crushed after standing in water for a definite period. This principle of testing finds much favor on the Continent, where the German manufacturers have largely introduced it. Unfortunately, however, if the merely tensile test imposed in England does not satisfy all the conditions of actual use, neither does the compression test; for cement, unlike simple mortar, is very often required to sustain continual or intermittent tensile strength. For an example of this, the use of cement in the construction of gasholder tanks may be cited. Here the walls are required first to sustain the exterior, or crushing, strain of the earth backing, and afterward the tensile strain, acting from within, of the contained water. Cement courses in the walls of ordinary buildings, in substitution for hoop iron bond, is another example of material exposed at once to a compressive and tensile stress.

It has lately been proposed by Mr. Isaac John Mann, in a paper presented to the Institution of Civil Engineers, to ascertain the adhesive strength of cement—*i. e.*, its power of clinging to foreign matter—as well as its capacity for holding together, or sustaining a crushing load. There is much reason in this proposal; for it is evident that, however cement is used—whether neat (in which case it would probably be in the shape of rendering) or mixed with sand or stones, as concrete—a good deal of its utility must depend upon its power of making a good joint with its surroundings. The importance of this quality is generally recognized in the care that is taken for insuring a perfect union between successive layers of concrete in forming a wall. Mr. Mann proposes to carry this system of testing to its highest development, by cementing together two slips of sawn limestone or ground plate glass. The difference between cohesion and adhesion is anything but insignificant; although, in regarding the work done by a plastic cement, this distinction may be lost sight of. To use a familiar illustration, a gasholder sheet and the black varnish upon it will exemplify the two qualities in their highest form. The iron is very strongly coherent—for a tensile strain of about 20 tons per square inch would be needed to part its molecules, which could again be made coherent at a sufficiently high temperature—but it has no adhesive power whatever. The varnish, on the contrary, has no coherence, but unlimited capacity for adhering to anything with which it may happen to be in contact. With Portland cement of good ordinary quality, gauged neat as it comes from the makers, and tested after seven days, the cohesive and adhesive strength may be in the proportion of 592 to 59, or by another test 336 to 51.

There is a consideration now to be mentioned, however, which is of the highest importance. Cement as it is delivered by the manufacturer consists of a mixture of very fine dust and coarser particles. Sometimes the latter may be truthfully regarded as an adulteration; but it is sufficient, for the present, to consider them as of the same nature and origin as the dust, but imperfectly ground. It is evidently a matter for the user to decide whether he will require the manufacturer to deliver his cement ground as fine as flour or otherwise. It can, of course, be done at a price. The matter stands thus: The large particles, when not quite inert, enter into combination so slowly as to be incapable of developing any great cementitious effect within the short period available for any commercial or industrial test. Consequently there must not be too many of them, or the tests, whether of adhesion or cohesion, will be poor. The influence of the coarse particles upon the cohesive and adhesive action of cement differs; for while, within a certain range, the presence of these coarse particles increases the former, it diminishes the latter. It might also be said that the effect of the same thing upon the test of resistance to compression would be different again. Whatever may be said as to the wisdom of adopting a standard test of adhesion, there can be no doubt that anything tending to increase this power, within reason, must improve the value of a sample of cement. Hence the additional importance now shown to belong to the perfect grinding of this material. As ordinarily sent out, 45·6 per cent. of cement is stopped by a No. 176 sieve—which is the finest procurable, having 31,000 meshes per square inch, or 176 silk threads to the lineal inch. Mr. Mann's experiments tend to show that, so far as concerns a seven days' test, the particles stopped by a sieve of this mesh, or 54·4 per cent of the whole bulk of the material, develop little or no strength within this period. By another series of tests it was also shown that the cement sifted through a No. 103 sieve (with 10,600 meshes to the square inch) has only one-fifth of the binding power of that which can pass through the No. 176 sieve. Nothing more is needed to show that the binding power of cement greatly depends upon the fineness of the particles composing it, apart from other considerations.

It is somewhat surprising that the roughness or smoothness of surfaces with which it is in contiguity does not affect to any very notable extent the adhesion of Portland cement; although, for many reasons, the cement adheres with varying tenacity to different substances. The following table shows how this power is manifested in cement obtained from five leading makers:

STRENGTH OF ADHESION OF PORTLAND CEMENT TO VARIOUS MATERIALS.

Material.	Average Adhesive Strength.				Remarks.
	7 days.	28 days.	13 wks.	6 mths.	
Bridgewater brick..	19	..	..		Ordinary cement.
" " ...	24	66	..	..	Sifted through No. 176 sieve.
Slate (sawn)...	49	..	..	.	Ordinary cement.
" "	53	82	..	62	Sifted through No. 176 sieve.
Portland stone.... .	26	50	..	..	Ordinary; fragments torn out of surface.
" "	29	62	..	55	Sifted through No. 176 sieve; fragments torn out of surface.
Ground plate glass.	..	102	113	..	Ordinary cement.
" " "	..	..	145	..	Sifted through No. 176 sieve.
Plate iron...........	23	62	..	..	Ordinary.
" "	44	66	..	..	Sifted through No. 176 sieve.
Sandstone...........	..	49	..	..	Ordinary; fragments torn out of surface.
Polished marble....	38	..	..	..	Ordinary cement.
" " ...	52	71	.	75	Sifted through No. 176 sieve.
" plate glass	47	40	..	70	Ordinary cement.
" " "	55	49	51	..	Sifted through No. 176 sieve.
Granite (chiseled)...	41	..	..	..	Ordinary.
" " ..	78	97	153	..	Sifted through No. 176 sieve.
Limestone, (sawn)..	57	78	98	..	Ordinary.
" " ..	78	93	116	..	Sifted through No. 176 sieve.

Total number of tests (omitting those of sawn limestone), 182.

We have only one remark to make on the results here recorded. It does not appear whether the average in all cases really represents the approximate effect, or is the mean of a number of widely different examples. It is evident that there may be all the difference in the world between various samples, according to their preparation, or they may be strikingly uniform. As our contemporary *Engineering*, in commenting on the same results, well remarks: "The connecting bond or film"—in a cement joint between regular surfaces—"is extremely thin, and it is well known that the value of such a joint largely depends upon the skill of the person making the joint. When two pieces of wood are carefully united by glue, the union is often so firm that it is easier to fracture the solid wood than to tear apart the glued junction; but still it is no uncommon sight to see glued articles fall to pieces." This is a sensible check upon assigning too much value to Mr. Mann's figures; but it is open to the objection that, after all, there must always be an allowance for bad workmanship, and the fact of glued work falling to pieces is no argument against the goodness of the glue, which is what may be said to be under consideration.

Mr. Mann's own conclusions upon his experiments, which were carefully conducted and well watched, are (1) that the true binding value of Portland cement can be best determined by testing its adhesive strength; (2) that the degree of pulverization is probably the only other condition, the practical importance of which will warrant an introduction into the standard system of testing, which should therefore include a standard sieve; and (3) that a sieve having 176 meshes to the lineal inch will be found sufficient for all practical purposes. It will be worth while to subject Mr. Mann's tests to extensive examination, in order to see whether they do furnish an additional guide to the qualities most desired in cement, when used in the construction of heavy engineering works. Further evidence is certainly needed upon this point.—*Journal of Gas Lighting.*

Coal and Candles.

In the course of his recent Society of Arts Cantor Lectures on "Solid and Liquid Illuminating Agents," Mr. Leopold Field, F.C.S., expressed the opinion that the formation of coal from vegetal matter is not always a process of such infinite time as is generally supposed. Wood, bearing marks of human labor, has been found partially carbonized; and even some piles driven by the Britons to retard the advance of Cæsar's armies have been found with decided traces of carbonization on their outer surfaces. Mr. Field exhibited specimens of all the links which connect coal and green wood, including samples of peat taken at different depths, which became denser and denser until, at a depth of 14 feet, they resembled lignite—though less dense—and only required pressure to reduce the material to a true coal. Mr. Field supposes that cellulose, $C_6H_{10}O_5$ (the fibrous matter of wood), is split up according to the equation $2C_6H_{10}O_5 = 5CH_4 + 5CO_2 + C_2$; and he supports his hypothesis by reference to the abundance of marsh gas and kindred hydrocarbons found in the vicinity of coal mines. The variation in constitution undergone by wood fiber while changing to coal is as follows:

	Carbon.	Hydrogen.	Oxygen.
Wood	100	12·18	88·07
Peat	100	9·85	55·67
Lignite	100	8·37	42·42
Bituminous coal..........	100	6·12	21·23
Anthracite................	100	2·84	1·74

Speaking in another part of his lecture of the comparative efficiency of candles of various compositions, Mr. Field stated that stearine candles are the best for work, as they never bend or gutter. The dead white color is, however, an objection; and the light of stearine is not so brilliant as that of paraffine. Sperm candles the lecturer characterized as very beautiful; and he expressed surprise that they are not more used, although acknowledging that the price has much to do with it. The great objection to paraffine candles is their liability to gutter, if of low melting point; and, further, to bend. The plasticity of paraffine is a curious quality, as it does not seem to be directly affected by the melting point. Ozokerit candles generally consume before the bending point is reached. In regard to illuminating power, an ozokerit candle being taken as 10, sperm is 7·5, wax is 7, stearic acid is 7·25, and tallow is 3·5. There can be no question, Mr. Field says, that paraffine candles do not as yet give as much light as they should do upon theoretical considerations, and which they would do were the same substance vaporized in a lamp. Mr. Field also admits that the cost of a candle will always transcend that of other forms of illuminants.

Veneer Making.

In an article on the subject of veneers the *Northwestern Lumberman* gives some interesting facts. Straight grained and moderately soft woods are sliced off a log by a weighted knife with a drawing cut, the log, or burl, being ten feet long and the veneers varying from one-eighth of an inch to one-fortieth of an inch in thickness, the width corresponding, of course, to the diameter of the log. A knife machine which gives a half rotary movement to a semi-cylindrical turned log, allowing a veneer to be cut following the log's diameter, produces wide veneers from logs of small diameters. But while the knife has opened up new possibilities in veneer manufacture, the saw has by no means been abandoned; such woods as ebony and lignum vitæ cannot be cut with a knife, while finely figured and consequently close grained mahogany, and some rosewood, are difficult to cut. The saw, therefore, has its place. Such saws must be very thin, and so finely adjusted that hardly the slightest variation will occur in the thickness of the veneers turned out. While a nicely arranged circular saw will turn out boards varying the twentieth part of an inch, which would be imperceptible, such a lack of uniformity in thin sheets would prove a damaging imperfection. Before being cut the veneer material must be carefully steamed, the same as in bending. A tight box twelve feet long and four feet deep and wide is used, and exhaust steam is utilized. An ordinary wood like black walnut, which has an open grain, will steam sufficiently in six hours, but the close grained South American woods require thirty-six hours. Mahogany will steam sufficiently in twenty-four hours. Mahogany, tulip, and rosewood, being hard to cut, require more and careful steaming, and a knife in the best condition. The veneers wrinkle when laid together, but straighten out readily when glued properly to a body. Veneers will dry in the air in about twelve hours, but are not kiln dried, although the latter method is used for lumber out of which veneers are to be made.

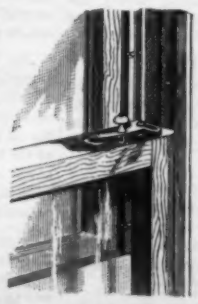
Steel Rails.

A manufacturing engineer writes to *La Metallurgie*, Paris, claiming that the success of rolling steel rails depends on the temperature at which the steel is rolled. He states from his own experience that bars which were finished at a bright red heat (and which were recognizable after cooling by their blue tint) were more fragile under tests by striking or flexion than those finished at a lower temperature.

RECENT INVENTIONS.

Improved Sash Fastener.

Messrs. Emanuel and Henry S. Ensnungen, of Bloomington, Ill., have recently patented a very simple and effective window fastener. This fastener consists of a latch pivoted to a plate which is attached to the upper rail of the lower sash. This latch swings in a horizontal plane, its motion being limited by a stud projecting from the plate through a slot in the latch. There is in the plate a socket into which the lower end of the thumb bit enters to lock the latch, the latch being so arranged at its pivot as to press the projecting end of the thumb bit into the socket in the plate. A notched bar is secured to the parting stop, and a similar notched bar is fastened to the upper sash alongside the parting stop, so that the latch may engage with either of them and thus secure either the upper or lower sash in any desired position.

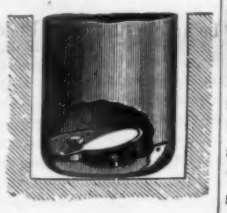


Lamp Chimney Cleaner.

A very simple device for cleaning lamp chimneys is shown in the engraving. It consists of a stick slit twice at right angles and provided with two plates bent at right angles and inserted in the slits. The whole is then clamped by a ring driven on the conical end of the stick. The handle is ridged as shown in the cut. In use a cloth or piece of wash leather or paper is wrapped around the plates, and the cleaner is inserted in the chimney and moved about. If chimneys of small diameter are to be cleaned, a cloth or piece of paper is wrapped around the ridged part, and that end of the cleaner is employed. This invention has been patented by Mr. A. Sahlstrom, of Stockholm, Wisconsin.

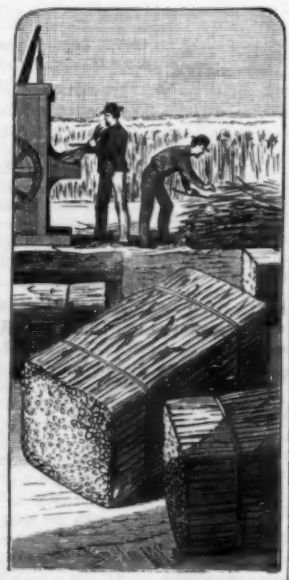
Well Bucket.

Those who have looked sadly into the old-fashioned well and watched the oaken bucket dancing mockingly on top of the water and refusing to turn itself over and sink and be filled, will gladly receive any apparatus tending to improve that state of affairs. The bucket herewith illustrated has a stamped sheet iron bottom of a downwardly concave form with a cylindrical collar, in which the body of the bucket is fitted. In the center of the bottom is a hole closed by a disk of iron having a slotted shank secured by a post on which the shank is free to play. On the under side is a leather or rubber cushion that insures a tight fit. Projecting from the center of the under side of the disk is a stem which forces the valve open when it strikes the bottom of the well. This invention has been patented by Mr. John Brunny, of Fort Scott, Kansas.



Cornstalk Fodder.

Cornstalks form excellent fodder for cattle, but owing to the difficulty of transportation much of this valuable material is either burned up or allowed to rot. Mr. Frank M. Bacon, of Plainfield, N. J., has patented an invention relating to the bale of cornstalks as a new article of manufacture. The stalks are in a crushed condition, and of lengths corresponding to the measurement of the bale in one direction, and are laid parallel so as to make the bale compact. In this form the stalks weigh no more than the same bulk of hay, are easily handled, and can be used when needed. The bale is pressed and secured by ropes or wires. A machine for crushing the cornstalks, and cutting and baling them, has been devised by the same gentleman.



Fast Time.

Probably the fastest train in America is the afternoon express on the Canada Atlantic Railway, which leaves Coteau Station at 5.35 and reaches Ottawa, distant 78·4 miles, at 7:09, having made one stop of three minutes at Alexandria. This is almost exactly fifty miles an hour. The fastest train in the world is probably the "Flying Dutchman," which runs without stopping from London to Bristol, a distance of 118¼ miles, in just two hours—a rate of 59⅛ miles an hour.

[NEW YORK SUN.]

Home Made Water Filters.

Pure water hardly exists in nature; it is insipid, and not adapted for drinking purposes. In speaking, therefore, of pure drinking water I shall use the term in a relative sense, indicating fitness. All I claim for water fit for drinking purposes is that it is free from everything of ascertained or suspected power to induce ill health, or which is unpleasant to the senses and the imagination.

All the eight water companies of London employ some system of filtration. The usual plan is to build a series of tunnels with bricks without mortar; these are covered with a layer of fine gravel two feet thick, then a stratum of fine gravel and coarse sand, and lastly a layer of two feet of fine sand. The water is first pumped into a reservoir, and after a time, for the subsidence of the coarser impurities, the water flows through the filter beds, which are slightly lower.

During the last summer I have been making experiments with simple filtering materials, and also talked the matter over with Prof. Cassamager, chemist to Messrs. Havemeyer's sugar refinery. Prof. Cassamager having to filter such a difficult material as sugar, I considered him an expert in all processes of filtration, and I asked him to arrange what he considered the cheapest and most simple form for filtering water. At his laboratory he showed me a method which he had arranged, which is, perhaps, the most simple that can be devised to give fair results.

This simple filter is made as follows: Procure an ordinary wood pail and bore a number of holes the size of a five cent piece all over the bottom. Next prepare a fine muslin bag, a little larger than the bottom of the pail, and about one inch in height. The bag is now filled with clean, well washed sand and placed in the pail. Water is next poured in, and the edges of the bag should be pressed against the sides of the pail. We put such a filter to very severe tests by mixing a dry sienna color in a gallon of water, and, passing through, the color was so fine as to be an impalpable powder, rendering the water a deep chocolate color. On pouring this mixture on to the filter pad and collecting the water, it was found free of all coloring matter. This was a very satisfactory test for such a simple appliance, and I cannot too strongly recommend it in cases where a more complicated arrangement cannot be substituted. The finest and cleanest sand is desirable. Sand purchased at glass manufactories should be obtained.

The above described filter at its best is but a good strainer, and will arrest the suspended particles. But in a modern filter more perfect work is required, and another effect produced, in order that water containing objectionable matter in solution should be rendered fit for drinking purposes. Many persons when they see a water quite clear seem to imagine that it must be in a good state for drinking. They should remember, however, that many substances which entirely dissolve in water do not diminish its clearness. Hence a clear, bright water may, despite its clearness, be charged with a poison or substances more or less injurious to health; such, for instance, as soluble animal matter.

To make a perfect filter, which should have the double action of arresting the finest suspended matter and removing the matters held in solution, and the whole to cost but little and capable of being made by any housewife, has been the object of my study for many months, and, after many experiments and testing various substances in many combinations, I suggest the following plan, which I find gives very perfect results, and will cost a couple of dollars.

Purchase a common galvanized iron pail, which costs fifty cents. Take it to a tinshop and have a hole cut in the center of the bottom about the size of a five cent piece, and direct them to solder around it a piece of tin about three-fourths of an inch deep, to form a spout to direct the flow of water downward in a uniform direction. Obtain about two quarts of small stones at a store in Maiden Lane where material for roofing is sold; after a good washing, place about two inches of these at bottom of pail to form a drain.

On this place a partition of horse hair cloth or Canton flannel cut to size of pail. On this place a layer of animal charcoal, sold at the wholesale chemists' in William Street as boneblack at about ten cents a pound. Select this about the size of gunpowder grains, and not in powder. This layer should be three or four inches. A second partition having been placed, add three inches of sand, as clean and as fine as possible. Those within reach of glassmakers should purchase the sand there, as it is only with that quality of sand that the best results can be obtained. On this place another partition, and add more fine stones or shingle—say for two or three inches. This serves as a weight to keep the upper partition in place.

Your filter is now complete, but not ready for use. However careful you may have been in washing the material, a residue of dust will remain, and this has to be gradually washed through. For this purpose pass as much water as possible through the filter during the first day without using it. The next day it will be ready for use, and, if my directions have been complied with, filtered water will be always at command, not only freed from all suspended substances, but from color due to matter held in solution having been removed. I found that the yellowish color of Croton water, which is very difficult to remove, was entirely absent in water passed through my filter. To test this, water must be filled up in a large white porcelain basin. In this manner the color of Croton water is plainly visible in contrast with the white china.

The filtering material, which is cheap enough, and particularly the partitions, should also be renewed at intervals, the time depending on the period of year and the nature and amount of the impurities.

For the benefit of those desirous of filtering water on a large scale with sand filtering beds, I would state that there should be one and a half yards of filtering area for each 1,000 gallons per day. For effective work the descent of the water should not exceed six inches per hour. The term "self-cleansing," applied to some filters on the market, may be correct in a limited sense, but no reliance should be placed on such filters, and none used which cannot be readily taken apart and thoroughly cleansed.

I have often noticed wood charcoal used in filters. The best authorities, however, claim that this material, when powdered, acts merely in a mechanical manner as a strainer, and that charcoal obtained from animal matter alone appears to possess the power of removing matters held in solution in water.

There is one filtering material which is little known in this country which has all the properties of animal charcoal, and is said to give higher results. This is magnetic carbide, discovered by Spencer, many years ago, and consists of protoxide of iron in chemical combination with carbon. It is considered that the purifying effect is produced by its power of attracting oxygen to its surface without the latter being acted on, the oxygen thus attracted being changed to ozone, by which the organic matter in the water is consumed.

There can be no doubt of the value of this filtering material, which is much used in Europe, and in some cases on a large scale, to purify the water of cities.

Its manufacture is very simple, as it is obtained by roasting hematite iron ore with granulated charcoal for twelve to sixteen hours at a dull red heat, and used in a granular form. Another form for making this material is to heat the hematite (red oxide of iron) with sawdust in a close vessel. The product is magnetic, and never loses its activity until the pores are choked up. I have endeavored to make the magnetic carbide by the second formula, but the result was not satisfactory on account of the hematite having only a small percentage of iron, giving a material similar to broken brick, whereas, if pure hematite is used, the result should be a brilliant black substance.

The Water Company of Southport, England, formed their filtering beds of this material, and I understand that after years of use it is still giving satisfaction.

Prof. C. F. Chandler, on one occasion, observed that "pure water is hardly second to pure air as a life-giving and life-protecting agent, and is the most potent servant the sanitary authorities can call to their aid."

I trust the home made filter here described may soon be found in every home, for a water supply loaded with a mass of filth and poisonous contaminations should be rejected without hesitation until cleansed from impurities by a good filter.

JOHN MICHELS.

Testing Gold Sands.

As a general proposition, says the *Mining and Scientific Press*, the results of assays of gold ore are not as satisfactory or reliable as those made for silver. The ordinary fire assay for gold, especially if the ore be of low grade, cannot be relied on. Very great care has to be exercised in the selection of the sample in the first place, and the amount of gold is so minute that only delicate manipulation will properly save and weigh it. The finest of balances with nice adjustment are required; and, altogether, when the whole is considered, miners of experience would rather judge from the results of "horning," or panning out a good liberal sample of ore properly pulverized. They can tell by the "colors" about what the ore will yield at the mill. In assaying gold ore by the blowpipe, the results depend greatly on the operator's skill and his judgment in the selection of samples.

In assaying the gold sand of the rivers, streams, and sea beaches of this coast (California) some difficulty is met with. It contains a great amount of specular and titanic iron, and is called "black sand" by the miners. Platinum and iridium are often found in the same sand. Mr. George Attwood, in his "Blowpipe Assaying," gives a convenient method of testing these sands:

"Take 100 to 1,000 grains and attack with *aqua regia* in a flask; cool for about thirty minutes or more; dilute with water and filter. If gold is present, it will now be held in solution in the filtrate. Remove the filter and evaporate the filtrates to dryness; then add a little hydrochloric acid and redissolve the dry salt in warm water; add to the solution so formed protosulphate of iron, which will throw down the gold in the form of a fine, dark precipitate. This precipitate is seldom pure, being mixed with oxides of iron, and must now be dried in the filter paper, and both burned over the lamp in a porcelain dish. Then mix the dried precipitate with three times its weight of lead; fuse, scorify, and cupel. In case platinum, iridium, etc., are found associated with the gold, an extra amount of pure silver should be added before cupellation, and the gold button will be found pure."

Consumption an Infectious Disease.

The Wisconsin State Medical Society, during its recent annual session, passed a resolution virtually declaring consumption to be an infectious disease, and urging the necessity of the proper isolation and disinfection of those suffering from it.

ENGINEERING INVENTIONS.

Mr. Benjamin H. Burling, of Fort Ann, N. Y., has patented a steam propelling rudder for vessels—a hollow rudder containing a steam engine driving a propeller wheel. The object is to assist in propelling the vessel ahead when the rudder is in line with the keel, and to assist in turning the vessel when the rudder is at an angle to the keel.

Mr. Charles H. Hyssong, of Altoona, Pa., has patented a piston valve which may be adjusted to vary the lap and lead without removing the heads from the case, and the adjustment of the packing rings can also be made with equal facility, as the valve rod is threaded and the pistons are held in place by nuts, and the packing rings are supported on a conical collar that may be adjusted laterally by a nut.

An improved car coupling has recently been patented by Mr. Matthias Ralph, Sr., of Ursa, Ill., in which the coupling pin is secured by a chain to a lever projecting from the end of the car, the lever being worked by a rod from the top of the car, and by means of a projecting arm, also from the top of the adjacent car if required. This device is intended to obviate the necessity of going between the cars to couple and to uncouple, and to prevent the loss of coupling pins.

Messrs. Adison D. Atwood and Charlie M. Atwood, of East Portland, Oregon, have invented and patented a combined car coupling and drawbar, which is adapted to cars of varying heights of frames, and which is self-coupling with cars of not widely different heights. For uncoupling and for adjusting the link receiver to cars of differing heights the device may be worked from the top of the car, or from either side, as may be most convenient.

Mr. A. J. Redman, of La Cross, Kansas, has invented a safe car coupling device, by which the connecting link may be guided into the link socket of an approaching car without handling the link directly. The link socket is formed with a convex lower face to form a fulcrum for the link, and the inner end of the link is depressed, so as to elevate the projecting end to the proper height for engaging with the link socket of the approaching car, by means of a pusher projecting through the upper portion of the link socket.

A quite ingenious device for placing torpedo signals on tracks without the necessity of stopping the train, has been patented by Messrs. Gilson F. Metcalfe and M. F. Haber, of Baltimore, Md. A wheel with two flanges and having a deep groove between them is mounted upon a movable bar, which is so arranged that it may be raised and lowered by means of a suitable lever, so as to bring the wheel in contact with the track when desired. The torpedo before the train is started is placed between the flanges of the wheel and is retained there by a metal strip; and when the wheel is lowered and rotated by contact with the track, this strip will be clamped on to the flanges of the track, whereupon the torpedo will be securely attached to the track.

MECHANICAL INVENTIONS.

A nail machine for making horse shoe nails, and intended for the production of two nails simultaneously, has been patented by Mr. John D. Wilkinson, of Plattsburg, N. Y. The machine forges two nails at once, and cuts them apart at the heads, leaving them all ready to be pointed.

Mr. Alexander Scouller, of Davenport, Ia., is the patentee of an eccentric and sliding box for giving the reciprocating motion to shakers, such as are used in grain mills for sifting, screening, and bolting, the intention being to make a simpler, more durable, and less noisy attachment than any at present in use.

An improved feed mechanism for saw mills has been patented by Mr. Edward S. Laughinghouse, of Kinston, N. C. This invention relates to a feed motion in which a shifting friction gear is combined with the saw arbor for securing a reversible rotary motion for operating the carriage.

Mr. Thomas J. Brough, of Baltimore, Md., has patented an improved carbureter for intermingling the vapors of a liquid hydrocarbon with atmospheric air in such proportions as to render the resulting mixture combustible and fit for use as an illuminating or heating agent. The invention consists in the improved construction of the machine.

A hooded circular saw guard has been invented and patented by Mr. Leonhard Hofmann, of Cincinnati, Ohio, which is adjustable to any height above the saw table to allow for the working of any thickness of lumber. The adjustment may be made instantly, and the guard is held rigidly in place at any elevation desired. It is designed to prevent accidents by circular saws.

A novel fire escape has recently been patented which consists in a balcony arranged to be raised and lowered in proper guides on the outside of the building by means of suitable ropes and pulleys. This is designed to be used as a balcony at the windows and doors of the house, but in case of alarm is ever ready to be used as a fire escape. The inventor of this device is Mr. Aaron Walker, of Kokomo, Ind.

An improved fruit drier has recently been patented by Mr. George S. Grier, of Milford, Del. This invention relates to that class of fruit evaporators in which series of trays are made vertically adjustable in an upright case, and the improvement consists in the means for giving to the trays an upward progressive movement, and also means for regulating the ascending current of hot air, so that the fruit will be thoroughly and evenly dried throughout.

Mr. William Maybury, of Garnersville, N. Y., has patented a steam tight journal box for rotary steam boilers, bleachers, and driers, to obviate the necessity for loose packing. The journals are formed with a series of rings which are fitted to corresponding annular recesses in the boxes, and the inner sides of the rings and recesses are held steam tight by the pressure of the steam admitted to the cylinder. Arrangements are made for automatic lubrication.

An improved cotton elevator and distributer has recently been patented which comprises several advantages over those commonly in use. In this improved machine the cotton is first fed on to an elevator through a suitable hopper and then it is carried on to a distributer. The bottom of this distributer is furnished with openings corresponding to the different stalls in the storage house, and a removable chute is provided which enables the cotton to be deposited into any of the compartments desired, where it is stored previous to being fed to the gin. Mr. Sidney W. Bartholomew, of Castalia, N. C.

Messrs. Samuel S. Hall and Joseph Walmsley, of Bury, near Manchester, England, have obtained a patent for an improved warping and beaming machine. The invention consists in improvements in the construction of the machine, and relates to a device for varying the speed of the section reel, so that the warping will be wound thereon at a uniform rate of speed from beginning to end; so that in spite of the increased size of the section as the work proceeds, the tension on the warp will be kept entirely uniform as the speed of the section reel will be increased proportionately to the increase in size of the section. Devices are also provided whereby some of the sections may be wound in a reverse direction from that of others.

An ingenious mechanical movement for transmitting circular motion, whereby small power applied may serve to overcome great resistance, has been patented by Mr. W. P. Campen, of Wilmington, N. C. Upon a shaft designed to be rotated by hand or cogs, are mounted three circular eccentrics one-third of a circle apart, so that their motions are relatively alternate. Each eccentric is provided with an arm which, when it is thrust forward by the motion of the eccentric, tends to act upon a ratchet wheel secured to a second shaft, and since there is one ratchet wheel for each eccentric, when two of the ratchet wheels are at dead center the third will be rotated by the action of its eccentric and a continuous motion thus obtained.

A dumping wagon, so constructed as to adapt itself to the circumstances in which it is placed with the greatest facility, so that it may be relieved of its burden regardless of its position, has been patented by Messrs. Henry S. Bernhart and Isaac R. Ritter, of Reading, Pa. The invention consists in a dumping wagon which can be raised at the rear end by quadrant racks mounted on the frame of the wagon and connected with the box, and at the front end by arms pivoted to the frame and to the box. Both the front and rear ends of the wagon can be raised or the front end only can be raised, by disengaging the quadrant racks from the pinions, for by turning the said shaft the chains will be wound on the same, and will draw the shaft provided with the rollers, and which form a truck with the said rollers, toward the rear end of the wagon frame, and will thus swing the arms connected with the box upward.

AGRICULTURAL INVENTIONS.

Mr. Felix T. Gandy, of Rubens, Kas., has patented a jointed harrow intended for the cultivation of corn planted in furrows between ridges, the harrow being in two longitudinal sections adjustable, so that the two wings will present inclined faces adapted to the slant of the ridges, between the rows of corn.

Mr. William Commeans, of Lilly Chapel, O., has patented a combined pulverizer and grader, intended to break up clods and to level or grade the plowed soil preparatory to planting. The teeth and scrapers are instantly adjustable to any depth in the soil, or may be raised entirely above the surface at the will of the operator.

Mr. H. C. White, of Jug Tavern, Ga., has invented and patented an improvement in cotton choppers, cultivators, and plows, combining the uses of three implements in one, and adapting it to the cultivation of cotton and other crops which are grown in rows or drills. The changes can be readily made, and the cutters, plowshares, and markers can be adjusted to work any width desired and to any required depth.

Mr. John T. Wilson, of Easton, Mo., has obtained a patent for a useful and improved corn sheller. This machine is so constructed that it will receive the ears of corn when thrown into its hopper promiscuously and will shell the corn from the cob, and separate the cobs from the shelled corn, the whole being done automatically and without a second handling being necessary.

Mr. William F. Edwards, of Covington, Ky., has invented a combined seed planter and fertilizer distributer, to be drawn by a team the same as a plow, and to be similarly guided. The hopper contains the fertilizer, which is stirred and comminuted by means of a cylinder armed with forks which receives its revolutions from a wheel on the outside, that supports the hopper and its load. A share in front and a coverer in the rear may be attached for seed planting.

Mr. Benjamin F. Christ, of Peabody, Kas., has patented an improved harrow which permits of the adjustment of the teeth from a perpendicular to an inclined position, and allows the teeth to arrange themselves parallel to the plane of draught, while their beams may be oblique to that plane. This construction of the harrow is also specially designed for strength, being strongly braced by diagonal and parallel bars of a Z-form.

A combined seed and fertilizer dropper has been patented by Mr. Geo. E. S. Phillips, of Berryville, Va. This implement consists in a stationary hopper and a rotary hopper within the stationary hopper, and having the devices which carry the valved cups connected to its inner and outer side so as to be rotated with it. The outer cups are fed with the fertilizer from the stationary hopper while the inner cups are filled with grain from the inner hopper, and the whole is so arranged that at certain intervals the grain and fertilizer will be deposited together in the mound.

An improved corn planter has been patented by Mr. Charles Porter Phelps, of Princeton, Ill. This planter is provided in front with runners for opening the furrows and with covering wheels located behind them, for forcing the seeds into the ground. Under the hopper are arranged horizontally two wheels carrying cups of suitable size for the grain or corn. These wheels are rotated by an agitating wheel which strikes against projections on the seed wheel, giving them an intermittent movement. Devices are provided for stopping the flow of the corn, for raising the runners from the ground, etc.

MISCELLANEOUS INVENTIONS.

A new and improved self-inking hand stamp, which operates easily and without jarring, has recently been patented by Mr. Louis K. Scotford, of New York city.

Mr. Bailey T. Milliken, of Paducah, Ky., has patented an improved design for a bed spring. The upper convolution of each coil is made polygonal instead of curved, and the connecting part is formed in such angles and curves as to render it elastic and springy and at the same time durable.

An abdominal supporter for women has been patented by Mr. Augustus Galny, of Galveston, Texas, the sack being made of fibrous light material, and supported by elastic bands passing over the shoulders instead of being a belt around the waist, thus relieving the liver and stomach from pressure.

A very convenient device for holding twine has been patented by Messrs. W. J. Greene and J. L. Herlick, of Marquette, Mich. The invention consists in a frame carrying a sliding weight arranged for drawing up the twine when released, so as to keep the loose end of the twine from off the counter and retain it in convenient position for use when wanted.

Mr. Hiram M. Wheeler, of Smithson, Ind., has obtained a patent for an apparatus for utilizing waste heat, and the invention relates to means for heating water or generating steam by the waste heat from an ordinary stove pipe or chimney. This tank must be located at a point above the source of heat, and it is adapted for supplying hot water to any floor of the house.

Mr. J. Edward Bicknell, of Cleveland, O., has invented an improved apparatus for making illuminating gas by the distillation of wood, as sawdust, and the decomposition of a liquid hydrocarbon, the apparatus being so contrived as to admit of continuous distillation without the necessity of stopping the work for charging and cleaning the retorts.

Messrs. F. Le Roy Tetamore and S. E. Fordham, of Brooklyn, N. Y., have patented a hand implement for applying and securing barrel head fastenings. The entire operation is performed readily by one person, using a single implement, and the fastenings are forced into the staves at equal distances by means of a gauge and a presser cam.

Mr. Arthur Wilfred Brewtnall, of Westminster, England, has invented improvements in the mounting and suspending of electroliers and other electric light fittings on the principle of the ball and socket joint, permitting free movement in all directions in a segmental plane, and still maintaining the electrical circuit unbroken.

Mr. James Buchanan Mitchell, of Los Angeles, Cal., has obtained patent for an improvement in fountain pens. In this invention the flow of ink to the pen from the reservoir in the hollow handle of the holder, is to be regulated by a valve placed in such position in the holder as to be operated by compressing the thumb and fingers.

Mr. Samuel Maxim, of Wayne, Me., is the inventor of an oil guard to kerosene lamps by which the rise or overflow of oil lamps is returned to the lamp, and by which any sudden outpouring of oil in case of the lamp being overturned is prevented. It consists of a chambered collar fitted to the neck of the lamp outside the threaded nipple of the cap or burner.

A board for playing a game of marbles is the subject of a patent recently issued to Mr. Edward W. A. Meyer, of Boston, Mass. It is a board inclined from both ends, the marbles being impelled up a long incline over the ridge, whence they roll into partitions or pockets on the short inclined side. This differs from a bagatelle board in being composed of two inclines instead of being on a level.

Mr. Magnus Gross, of New York city, has patented an improvement in an apparatus for decomposing steam for the manufacture of water gas, in order to avoid the unreliable and intermittent operation of the retorts generally used, consequent on the cooling influence of the steam. He makes an additional retort called a superheater, into which the steam is conducted and raised to the proper temperature.

A new folding rocking chair has been patented by Mr. John E. Cotton, of Fairfield, Me. The parts are less in number than usual, and the chair when folded occupies very little space. When erected for use the chair is comfortable, safe, and portable; its method of construction makes the chair, when used, very rigid, giving a sense of safety that does not always accompany this description of portable chairs.

Mr. Arthur Alexandre, of Paris, France, has patented a device for holding the clasps of purses, reticules, and toilet bags without employing any swinging catch, knobs, or similar projections. The two bows are perfectly plain except at their ends near the rivets, or pivots, and there one bow has a convex projection and the other a corresponding concavity, the elasticity of the bows insuring the locking of the bows in position.

A useful commode has been patented by Mr. Hugh H. Hughes, of Fair Haven, Vt., which is adapted to the use of either grown persons or children, by being made in horizontal sections with suitably sized seats for each section, which seats are contained in the cover. The cover is upholstered and may be used as a seat, and if not used for its specific purpose, the commode may be made a receptacle for boots and shoes and blacking materials.

An improvement for drying fruit or for evaporators of fruit has been patented by Mr. Joseph M. Duncan, of Warsaw, N. Y., in which the heated products of combustion are made to do useful duty instead of being allowed to escape while still hot. By this improvement a more even heat is given to the pan, and a larger proportion of the heat is utilized than when a portion of the products of combustion are allowed to pass over the top of the partition wall of the furnace.

Mr. William Halkyard, of Providence, R. I., has patented a sheet metal covering for telegraph, telephone, and electric light wires and cables, consisting of sheet metal lapped over the wire and its non-conducting envelope, the lap running longitudinally and being preferably soldered. This armor or covering may be very light and at the same time be very strong, so that the wire itself need not be depended upon for tensile strength.

An improved metallic box cover has been patented by Mr. Alton H. Fancher, of Brooklyn, N. Y., which is intended to prevent lateral movement of the cover on its hinge, and to insure a perfect meeting of the lid and the edges of the box all round when closing of the box is attempted. By an improvement in the shape of the cover blank from which the hook hinge is formed, the expense of manufacturing is also greatly reduced.

Messrs. Theodore Hunger and Frederick Ballenkamp, Jr., of Brooklyn, N. Y., are the patentees of an improved wagon end gate fastener, by which the end gate, or tail board, can be held in any position desired, being securely fastened not only when closed, but when on a level with the wagon floor, and also when swinging vertically. The closing and securing are automatic, and the opening more convenient than ordinary spring fastenings.

Mr. Wesley F. Marsh, of North Platte, Neb., has invented and patented a handy trestle for the use of painters, plasterers, carpenters, and others, by the use of which temporary trestles of varying heights and lengths may be avoided. This device allows the top bar of the trestle to be raised and fixed at any required height, within reasonable limits, and permits, also, the extension apart of the end supports. It can be taken in pieces and be easily moved from place to place.

Mr. Charles Maliphant, of New Brighton, N. Y., has invented a fire escape to be used on the outside walls of buildings, which consists of two carriages operated by a single rope, and being guided in their ascent and descent by upright bars extending from the street to the eaves. The movement of the carriages is similar to that of an elevator, and provision is made for checking the descent of either carriage should the suspending rope break. When not in use the carriages may remain as balconies at the windows.

An improved grain separator has recently been patented which consists in a screen having a series of annular compartments, and obliquely arranged chutes adapted to gather the grain in one part of the revolution of the screen in one compartment and discharge it at a different part of its revolution in another compartment, and the screen further consists in an inner apertured cylinder and a return imperforate cylinder, the whole being so arranged as to thoroughly separate the grain from the chaff. Messrs. Milton Forder and T. B. Pendergast, of Dassel, Minn., are the inventors.

An improvement in awnings is patented by Mr. Joseph Moynan, of Brooklyn, E. D., N. Y., designed to firmly secure the awning when spread and to effectually protect it when furled. The triangular end curtains of the awning are folded under the main awning when the awning is to be furled, and the entire awning canvas is rolled on a spring roller contained in a box on the front of the building, the box being an ornamental cornice. When thus rolled, the aperture in the front of the cornice box is closed by a signboard, which depends from the front of the awning when it is extended.

Mr. John N. Purdy, of St. John, Province of New Brunswick, has patented an improvement in the catting and fishing of anchors on board ship, by which all incumbrances, such as wooden frames in the forecastle, the cutting of holes in the top gallant forecastle, and the employment of the ship's windlass or capstan in catting the anchor, are avoided. This is effected by using a light windlass and frame on the cathead, and a small fishing davit on the rail. When at sea this supplementary windlass may be removed from the cathead and stowed.

Mr. Howard R. Burk, of Brooklyn, N. Y., has invented a method of giving a pleasing tint to kerosene oil without impairing its quality, the object being to impart a bluish color, which when burned in glass lamps is preferred by many to the yellowish tint of ordinary kerosene. He employs olive oil, or some other oil dissolvable in kerosene, giving the oil an intense blue and then dissolving it in kerosene, one quart of olive oil being sufficient, when treated according to his method, of tincturing two hundred quarts, or more, of kerosene oil.

An improved nose piece for eye glasses has been patented by Mr. William J. Suttle, of New York city. The object of this invention is to provide a nose piece which will be less easily broken when being secured to the eye glass or when dropped than the ordinary nose piece. The invention consists in providing the eye glass nose piece with a covering layer of some non-conductor or poor conductor of heat, such as rubber, varnish, japan, or other gums, which material is applied to the nose piece in a liquid or plastic state, and then dried or hardened. This covering layer does not interfere with the elasticity of the nose piece, and protects the skin of the nose from being disfigured or marred by the metal nose piece.

Mr. Keyran J. Duggan, of Montgomery, Ala., has invented a spike puller for use by railway trackmen, lumbermen, and others requiring a tool of this class which shall not need frequent and expensive repairs. The invention consists in a bar or lever fitted with a removable claw head having an inclined tenon fitting in a flaring mortise of the bar, and locked in place by a tapering stud or key formed on the removable heel piece or block of the tool, whereby different claw heads may be interchangeably and quickly fitted to the main bar should the claw head in use be accidentally broken, the construction thus also permitting the use with the one main lever or bar of claw heads of varying size, shape, and strength, as may be needed.

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Catalogues free.—Scientific Books, 100 pages; Electrical Books, 14 pages. E. & F. N. Spon, 35 Murray St., N. Y.

Straight Line Engine Co., Syracuse, N. Y. See p. 188.

NEW BOOKS AND PUBLICATIONS.

THE FORTIFICATIONS OF TO-DAY. By Colonel John Newton, of the Corps of Engineers, U. S. A., and President of the Board of Engineers for Fortifications. Translated from German and Italian sources.

This series of papers consists of three divisions illustrated by charts. It is intended as a treatise on artillery practice applicable to seacoast defense. The treatise—which may be considered as a manual—comprehends the fire against batteries, horizontal and curved fires from guns, served either from fixed points, as a fort or battery on land, or from movable positions, as a vessel at sea, or subjected to the erratic movements of the swell or tide; and the best methods of repelling attacks on fortified or defensive positions, as a vessel at sea, or subjected to the erratic movements of the swell or tide, and the best methods of repelling attacks on fortified or defensive positions made either by sea or by land.

MUSTER ALTITALIENISCHER LEINENSTICKEREI (DESIGNS AND PATTERNS OF OLD ITALIAN CROSS STITCH EMBROIDERY ON LINEN). 1st and 2d Collections. By Freida Lipperheide. Published by Franz Lipperheide, Berlin, 1881 and 1883.

The authoress of this work has made a very careful collection of designs of old Italian cross stitch embroidery on linen, and has also provided her work with descriptions and illustrations of the frames to be used in making the embroidery, and with a full and detailed description of the manner of making the stitches. Most of the stitches are illustrated on an enlarged scale, which is a very great help to those who wish to acquire the art of making cross stitch embroidery. She has also given designs for curtains, portieres, lambrequins, napkins, aprons, table cloths, tidies, bed covers, and canopies ornamented with cross stitch embroidery. The first volume contains thirty steel plates of designs, which are beautifully executed, and show the designs in such a perfect manner as to greatly facilitate copying them on linen. The second volume, which was published two years later than the first, also contains elaborate descriptions and illustrations of the stitches, and of portieres, tidies, etc., ornamented with the same. The second volume contains thirty steel plates of designs of the same execution as those contained in the first volume. The entire work is finished in an excellent manner, the binding, printing, engraving, and general arrangement being perfect in all respects.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at the office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) R. T. asks how to build a furnace for melting brass for small moulds. A. A small furnace that will melt five or six pounds of brass may be made upon the forge hearth in this wise: Build around the tuyere a chamber or box of fire brick about 10 inches diameter inside and 14 inches high above the tuyere; bank up around the outside with sand to keep the fire in (you will need no mortar). Use charcoal for fuel. A blacklead crucible 6 inches high and 4 inches in diameter at the top will hold 5 or 6 pounds metal without danger of spilling. Build a fire as you would for forging, fill the chamber nearly full of charcoal, set the crucible on top with the metal in it, fill in around the crucible as it settles down. Blow the fire slowly at first; as the crucible settles down even with the top of the chamber, place some fire bricks so as to draw in the top of the fire. A little care and judgment with one or two trials ought to give you a fair understanding as to the management of the crucible. If you use old brass you will get along easily. If you make new brass, you will find that the melting of the copper will test your ability to produce a hot fire, yet it can be done. We recommend you get "Overman's Moulder's and Founder's Pocket Guide," $2.00.

(2) A. C. S. asks: What would be the minimum daily expense of running a 50 foot steam yacht, also the number of men required to properly manage the same? A. Can be run with an engineer, pilot, and one deck hand; their cost you can compute from wages paid. You would probably burn 2,000 to 2,500 pounds coal per day of ten or twelve hours. Add say 25 or 30 cents per day for oil, waste, etc.

(3) J. C. asks: What effect will rock salt in solution, that has been used in salting hides, have on vitrified drain pipe? A party claims that it will destroy the vitrifaction, that it will crystallize in the pipe and render it porous and rotten. The writer has been told that rock salt used as above has passed through 18 inches brick wall, 6 inches cement and 15 inches party wall, and that nothing but glass is safe against it. A. Rock salt will have no effect whatever upon a well vitrified pipe, but it will permeate very readily a poorly glazed pipe, and will effectually spoil it. Brick being very porous, the slightest fault in the cement would enable the solution to saturate the wall and crystallize therein as mentioned.

(4) T. M. C. writes: In springs of the shape of watch springs is the method of obtaining the efficiency of such merely experimental? If not, what is it? What should the best and strongest springs be made of? A. The efficiency of watch and other similar springs is at first found by experiment, in which the thickness, width, and length are taken into consideration. The different grades of steel and the degrees of tempering are variable, leaving no exact gauge in the manufacture. The only proper material for working springs is steel, of the kind sold as spring steel.

(5) F. W. Bacon, Boston, Mass., sends us a practical receipt for gluing leather to iron. Paint the iron with some kind of lead color, say white lead, and lampblack. When dry cover with a cement made as follows: Take the best glue, soak it in cold water till soft, then dissolve it in vinegar with a moderate heat, then add one third of its bulk of white pine turpentine, thoroughly mix, and by means of the vinegar make it of the proper consistence to be spread with a brush, and apply it while hot; draw the leather on quickly and press it tightly in place. If a pulley, draw the leather around as tightly as possible, lap, and clamp.

(6) M. E. A. asks how to construct a dialytic telescope 6 or 8 inches diameter and 6 or 8 feet focal distance. Please state the kind of object glass and the size of the correcting lenses. How far they are to be placed from the object glass, what their focal distance is to be, etc. A. For a dialytic telescope of from 6 to 7 feet focus use a plano-convex crown glass lens 6 inches diameter, 35 inch focus, plane side next the eye, for the object glass. A plane concave flint glass lens 3½ inches diameter, 27 inch focus. Concave side next the eye and at a distance of about 17 inches from the object glass, varying the distance for a final correction.

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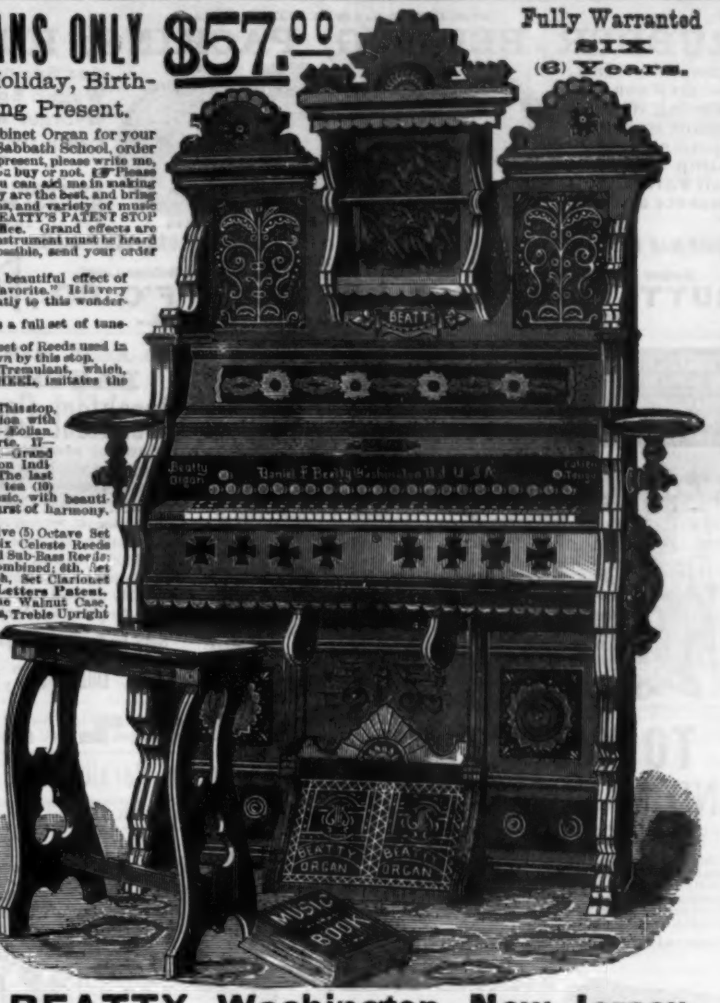

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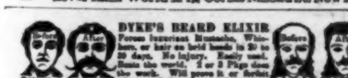
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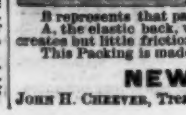

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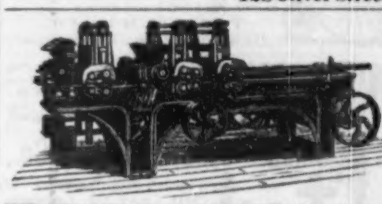

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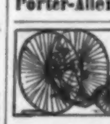

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